Bioneat Inc.

Comparative Analysis:

BioNeat NTS-1

vs.

Simple Green, Zep, Ecolab, and Seventh Generation

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Prepared by:

Joseph Correia II

Chief Marketing Officer

Approved by:

William Cibotti

Chief Executive Officer

Introduction

This analysis compares **BioNeat NTS-1** – a new surfactant-based "nanoparticle" cleaner – against four leading cleaning product brands: **Simple Green**, **Zep**, **Ecolab**, and **Seventh Generation**. Both **industrial/commercial** and **consumer** use-cases are considered. Key dimensions of comparison include: (1) efficacy against bacteria, viruses, and grease/oil; (2) human safety/toxicity; (3) environmental impact (especially aquatic/marine); (4) certifications (e.g. EPA Safer Choice, USDA BioPreferred, OMRI, FDA GRAS); and (5) third-party testing or validations (OECD biodegradability, NTPEP, ISO 17025 lab studies, etc.). A summary comparison table and a discussion of BioNeat NTS-1's unique differentiators are provided for clarity.

1. Efficacy Against Bacteria, Viruses, and Grease/Oil

BioNeat NTS-1: BioNeat NTS-1 is a highly effective **multipurpose degreaser** and cleaner. Its formula is a **"nanoparticle/colloidal micelle"** surfactant system derived from fatty acids, plant enzymes, and minerals (BioNeat NTS™ — Bioneat | The Future of Clean). These nano-sized colloidal micelles penetrate and break apart large grease/oil molecules "like miniature jackhammers," rendering oils and grime water-soluble so they can be lifted and rinsed away (FAQs — Bioneat | The Future of Clean). This gives BioNeat exceptional efficacy on grease and hydrocarbons – the product is marketed as *"the best degreaser on the planet"* for tough oils and grime (FAQs — Bioneat | The Future of Clean). In practice, users can dilute the concentrate with water (required for the nanoparticles to activate) and adjust dilution, dwell time, agitation, or heat to tackle anything from light dirt to heavy grease (FAQs — Bioneat | The Future of Clean) (FAQs — Bioneat | The Future of Clean). BioNeat NTS-1 is suitable on a wide range of surfaces (metals, plastics, concrete, fabrics) without damage (BioNeat NTS™ — Bioneat | The Future of Clean).

Though **not an EPA-registered disinfectant**, BioNeat has demonstrated **antimicrobial effects** in independent lab tests. A third-party laboratory test showed BioNeat (at 1:30 dilution) can kill bacteria like *E. coli* and *Salmonella* – achieving efficacy comparable to common "antibacterial" cleaners – despite containing no traditional biocidal chemicals (FAQs — Bioneat | The Future of Clean). (Regulatory note: BioNeat is not labeled or marketed as an "antibacterial" because doing so would require adding a registered pesticide, which BioNeat deliberately avoids to maintain non-toxicity (FAQs — Bioneat | The Future of Clean).) In other words, BioNeat's surfactant action physically destroys or removes bacteria (e.g. by dissolving cell membranes) even though it has no added toxic antimicrobial agents. For viruses, surfactant cleaners generally can inactivate **enveloped viruses** by disrupting their lipid envelopes. BioNeat has indeed been tested for virucidal activity: one 2020 lab study (Microchem Laboratory) found BioNeat achieved a **3.00 $\log_{10}$ reduction (99.9% kill)** in viral titer after 10 minutes on a test virus (Bioneat Data Index.pdf). This indicates significant efficacy against certain viruses (likely an enveloped virus in that test). However, like most non-bleach, non-quat cleaners, BioNeat is less effective on tough **non-enveloped viruses** – an earlier study on a norovirus surrogate (murine norovirus) showed only ~0.8 $\log_{10}$ (80%–85%) reduction after 10 minutes (Bioneat Data Index.pdf) (Bioneat Data Index.pdf), which is below disinfectant standards. In summary, BioNeat can **remove and even kill many bacteria and some viruses via its cleaning action**, but it is not a registered disinfectant for guaranteed pathogen elimination. Its strength lies in *mechanical removal and*

suppression of germs when used properly – the BioNeat FAQ even suggests **not rinsing** in some cases so that a residual surfactant layer remains to suppress microbes (except on oil-sensitive surfaces) (FAQs — Bioneat | The Future of Clean) (FAQs — Bioneat | The Future of Clean).

On **grease and oil**, BioNeat NTS-1's performance is a standout. The nanoparticle micelles act as a *"unique hydrocarbon release agent"* that lifts oils, grease, grime, and stains without damaging surfaces (BioNeat NTS™ — Bioneat | The Future of Clean). It has been successfully applied in diverse settings – from household kitchens and garages to heavy industry and even oilfield operations (BioNeat NTS™ — Bioneat | The Future of Clean). The product's ability to break apart petroleum oils has led to its use as a **surface washing agent** for oil spill cleanup; BioNeat complies with EPA's aquatic toxicity standards (EPA 821/R-02-012) for such applications (BioNeat NTS™ — Bioneat | The Future of Clean). In practical terms, users report that oily residues **"melt away"** when cleaned with BioNeat (FAQs — Bioneat | The Future of Clean). Even difficult residues (tar, grease in machinery, etc.) can be removed with appropriate concentration and dwell time. This high degreasing efficacy rivals or exceeds that of traditional solvent or caustic cleaners – **without** their harsh effects. BioNeat can even dissolve insect exoskeleton oils, functioning as an insect-control solution (it breaks down the waxy exoskeleton, causing pests to perish) (FAQs — Bioneat | The Future of Clean). Such versatility in degreasing and cleaning tough biological soils is a unique strength of BioNeat NTS-1.

Simple Green: *Simple Green All-Purpose Cleaner* is a well-known *water-based* cleaner and degreaser. It is formulated for broad use (household and light industrial) to remove dirt, food soils, and grease. Simple Green is effective on everyday grime and moderate grease build-up: it is advertised to "remove dirt, grease, and stains" on a wide variety of surfaces (Simple Green | US | Household | All Purpose Cleaner). On **grease/oil**, Simple Green is generally effective for light-to-medium duty degreasing (e.g. kitchen grease, tools, engines with moderate oil). It can be used full-strength on heavy messes or diluted for routine cleaning (Simple Green | US | Household | All Purpose Cleaner). However, for **very heavy or baked-on grease**, Simple Green's cleaning power is somewhat limited compared to more aggressive degreasers – it may require scrubbing or repeated applications. (Indeed, industrial users sometimes opt for stronger caustic or solvent cleaners for carbonized grease.) Still, Simple Green strikes a good balance for most non-extreme grease cleaning tasks. It's even listed on the EPA's National Contingency Plan as a **Surface Washing Agent** for oil spills, to be sprayed on oil slicks at ~1:4 dilution (SIMPLE GREEN® | US EPA) (SIMPLE GREEN® | US EPA). In that context it has been deemed "equally effective in fresh, estuarine, and marine environments" for dispersing oil, though high concentrations can be toxic to aquatic life (in tests, fish LC50 ~27.9 ppm) (SIMPLE GREEN® | US EPA) (SIMPLE GREEN® | US EPA). This demonstrates that Simple Green can tackle hydrocarbon soils, albeit not as uniquely as BioNeat's nanoparticle mechanism.

In terms of **bacteria/viruses**, the standard Simple Green All-Purpose Cleaner is **not a disinfectant** and makes no kill claims. It contains no registered antimicrobial ingredients. Its cleaning action will physically remove many microbes from surfaces, but it is not designed to *kill* pathogens at a high rate. (Simple Green's manufacturer offers separate products for disinfection, such as Simple Green d Pro 5 or Clean Finish, which contain quaternary ammonium compounds – but those are different formulas.) The all-purpose formula is similar to BioNeat in that it uses surfactants to clean; surfactants can disrupt lipid membranes, so one could expect Simple Green

to inactivate some **enveloped viruses** (like coronaviruses) and reduce bacteria on surfaces by washing them away. Indeed, soap and surfactant cleaners in general are known to destroy many enveloped viruses (as seen with handwashing and COVID-19). But without official data, Simple Green should be regarded as a **cleaner only**: effective at soil removal (which indirectly helps remove germs) but not an EPA-approved sanitizer. Notably, in the EPA's own technical bulletin, Simple Green was noted as **safe on skin** and causing no irritation for most users, with only mild eye irritation possible (SIMPLE GREEN® | US EPA), and it contains "no known EPA priority pollutants" (SIMPLE GREEN® | US EPA) – emphasizing its role as a safe cleaner rather than a disinfectant.

Zep: *Zep* is a broad brand with an extensive product portfolio, so efficacy varies by specific product. For comparison, we consider Zep's general-purpose and degreaser lines. **Grease/Oil Removal:** Zep manufactures some of the **strongest degreasers** available in the consumer and industrial market. For example, **Zep Industrial Purple Degreaser** is a pro-grade cleaner formulated with **high alkalinity (caustic soda)** and powerful surfactants/solvents. It is extremely effective on heavy petroleum grease, engine oil, and grime – users report it "quickly remove[s] stubborn grease and oil stains from engines" and concrete (Industrial Purple Cleaner and Degreaser, 5 Gallon - No. ZU08565G) (Zep Industrial Purple Cleaner & Degreaser Concentrate Gal). However, such strength comes at a cost: Zep's Purple degreaser is **corrosive** (classified as a corrosive alkaline liquid per its SDS) and can attack certain metals (it will etch aluminum if not used carefully) (Simple Green as a wash - Chevrolet Corvette Forum Discussion). It requires protective gear to handle and is intended for tough jobs. Zep also offers **solvent-based degreasers** (like citrus solvent cleaners or others containing glycol ethers) which excel at dissolving oils but emit VOCs and can pose toxicity if used without ventilation. In contrast, Zep's portfolio also includes **safer, milder cleaners** for lighter duty. A notable example is **Zep GreenLink Multi-Clean Green**, a multi-purpose cleaner/degreaser that is **Green Seal GS-37 certified** for environmental safety (Multi-Clean Green – Zep Inc.) (Multi-Clean Green – Zep Inc.). This product is non-toxic, contains no carcinogens or chlorinated solvents, and still provides excellent degreasing for routine needs (Multi-Clean Green – Zep Inc.). It can be diluted for various applications (ovens, floors, machinery, etc.) (Multi-Clean Green – Zep Inc.). Thus, Zep's efficacy against grease spans from adequate (for the green formula) to exceptional (for the heavy-duty Purple formula), depending on the specific product. In general, Zep's *flagship products* have a reputation for tackling "tough stains and grease" quickly (Zep Home Pro Streak-Free Multi-Surface Cleaner - 32 Fl. oz. - Walmart) (Zep 172 Oz. Purple Pressure Wash Outdoor Cleaner | Do it Best) – many professionals use Zep when other cleaners are not strong enough. The trade-off is that the strongest Zep cleaners may be overkill or unsafe for casual/home use. Zep's more moderate cleaners (including some all-purpose sprays sold in retail) are comparable to Simple Green in grease-cutting ability, while their industrial line surpasses it in strength (with appropriate precautions).

For **bacteria and viruses**, Zep likewise sells dedicated disinfectant cleaners (e.g. Zep Antibacterial Disinfectant Cleaner with quats, or peroxide-based disinfectants). Most plain surfactant-based Zep cleaners do not inherently kill germs to regulatory standards. Some Zep formulas combine surfactants with antimicrobial agents (Zep has bleach cleaners, quat cleaners, etc., primarily for commercial janitorial use). But if we limit to "surfactant-based" products, a standard Zep multi-surface cleaner would be used for cleaning and would require a separate

sanitizer for microbial control. One interesting case: Zep's **All-in-1 Pressure Wash Cleaner** (used for outdoor cleaning) is actually **EPA Safer Choice "Direct Release" certified** for safe release into the environment (ZEP 172 oz. All-in-1 Pressure Wash ZUPPWC160 - The Home Depot). That product likely relies purely on surfactants and mild builders; it would clean dirt and algae but not disinfect. In summary, **Zep (brand)** offers high efficacy on grease and soils – up to heavy-industrial levels – but **antimicrobial efficacy** depends on using specific disinfectant formulations in their line. Their pure cleaners (GreenLink, etc.) focus on soil removal and are not labeled to kill bacteria/viruses, similar to Simple Green and Seventh Generation in function.

Ecolab: *Ecolab* is a global leader in institutional and industrial cleaning solutions. Rather than a single product, Ecolab provides tailored chemicals for different industries (food service, healthcare, manufacturing, etc.). Ecolab's cleaners are generally categorized by use-case: **all-purpose cleaners, degreasers, sanitizers, disinfectants, floor cleaners**, and so on. Therefore, efficacy must be considered in context.

For **grease/oil cleaning**, Ecolab's offerings range from mild neutral cleaners to extremely aggressive degreasers. On the mild end, Ecolab has multi-surface cleaners used in hospitality or foodservice that are safe on most surfaces (analogous to Simple Green in strength). On the heavy end, Ecolab supplies kitchen degreasers and industrial cleaners that can dissolve baked-on fats and carbonized grease (for example, Ecolab's **GreaseLift** or **Oven & Grill Cleaner** for restaurant equipment, which can involve caustic or solvent ingredients). In food processing plants, Ecolab's alkaline CIP (Clean-In-Place) cleaners are formulated to **saponify oils and fats** with high efficiency (often containing caustic potash or sodium hydroxide for stainless steel equipment cleaning). These products are very effective on grease but are corrosive and require PPE. Ecolab also has innovative degreasers like **solvent-free surfactant blends** or **enzymatic cleaners** for specific soils. Given this spectrum, Ecolab can achieve whatever grease/oil cleaning efficacy is required by the customer: if a gentle cleaner won't cut a particular soil, a stronger Ecolab product is available. One noteworthy Ecolab innovation is the use of **peroxide-based cleaners** (e.g. *OxyCide™ Daily Disinfectant Cleaner* which contains hydrogen peroxide and peracetic acid) – while primarily a disinfectant, its oxidizing action also helps remove organic residue. OxyCide's active ingredients break down into harmless **water and vinegar after use (** **Ecolab Inc. - Ecolab Recognized as EPA Safer Choice Program Partner of the Year** **)**, indicating Ecolab's approach to pair efficacy with environmental safety. Overall, Ecolab's degreasers in industrial settings can match or exceed the strength of Zep's heavy-duty products (because customers like food manufacturers or automotive plants demand high performance). For everyday all-purpose cleaning, Ecolab provides concentrates that, when diluted via dispensing systems, perform similarly to other general cleaners on dirt and light grease.

In terms of **bacteria/virus efficacy**, many of Ecolab's products are **designed to meet strict sanitation standards**. In healthcare and foodservice, Ecolab supplies EPA-registered disinfectants (quaternary ammonium compounds, peroxide/acids, chlorine-based sanitizers, etc.) which are proven to kill 99.9–99.999% of pathogens (bacteria, viruses, fungi) as required by regulations. However, those are not purely surfactant-based (they contain active antimicrobial chemicals). Focusing on surfactant cleaners alone: like all surfactant cleaners, Ecolab's general cleaners will physically remove microbes and possibly inactivate some (especially enveloped viruses or gram-negative bacteria with oily membranes), but they are not intended to provide a

validated kill rate. Ecolab often pairs a cleaning step with a separate sanitizing step in protocols (e.g. in food processing, an Ecolab alkaline cleaner is used first to remove soil, then an Ecolab sanitizer is applied to kill residual microbes). One can say **Ecolab's strength in efficacy lies in its specialized products** – for any given target (grease, specific bacteria, etc.), Ecolab likely has a formula optimized for it. For example, for biofilms (bacterial slime), Ecolab has enzyme-based cleaners; for norovirus outbreaks, they have a peracid disinfectant, etc. This specialization is a different approach than a single product like BioNeat aiming to handle "anything washable" in one formulation. So, while Ecolab's *individual surfactant cleaners* may not themselves kill bacteria/viruses, the company's integrated solutions ensure high efficacy in professional hygiene outcomes.

Seventh Generation: *Seventh Generation All-Purpose Cleaner (Free & Clear)* is a **plant-based household cleaner** formulated to handle common messes in homes and offices. It is known to "tackle tough messes, and cut grease, grime, and dirt" on most hard surfaces (All Purpose Cleaner - Fresh Morning Meadow | Seventh Generation). Its surfactant system (which includes a plant-derived glucoside and a fatty alcohol ethoxylate (All Purpose Cleaner - Free & Clear | Seventh Generation)) is effective for general cleaning – kitchen countertops, appliance exteriors, floors, etc. On **grease**, Seventh Generation's all-purpose cleaner is competent for typical kitchen grease (e.g. stovetop splatters) but is mild compared to concentrated degreasers. It will clean oily film with some soaking and wiping, but for really heavy oil (like automotive grease or thick fryer oil deposits) it may not be as quick or powerful as BioNeat, Simple Green, or Zep's stronger products. In essence, Seventh Gen prioritizes safety and eco-friendliness, accepting that extremely tough grease might need multiple applications or a stronger approach. For everyday needs, however, users often report it "cuts grease and doesn't leave streaks or residue" (All Purpose Cleaner - Free & Clear - Seventh Generation), delivering a satisfactorily clean surface. Seventh Generation also makes a *Professional* line version of the all-purpose cleaner (similar formula) which they promote for commercial use on general soil – it's still the same gentle but effective cleaner, just in larger packaging.

Regarding **bacteria and viruses**, Seventh Generation's all-purpose cleaner is **not a disinfectant**. The company clearly notes this on their website: "Our All-Purpose Cleaner is not a disinfectant… for a disinfectant option, see our Seventh Generation Disinfecting Cleaners that kill 99.99% of germs botanically" (All Purpose Cleaner - Free & Clear | Seventh Generation). Thus, the Free & Clear cleaner should be used for cleaning only, and if germ-killing is required (e.g. during illness outbreaks), one should use their thymol-based disinfectant spray or wipes. The all-purpose cleaner formula itself contains no antimicrobial actives aside from the low-level preservation agents (which keep the product from spoiling but are not meant to sanitize surfaces). Like its peers, it will *remove* microbes with thorough wiping – and because it is free of harsh chemicals, it can be safely used around food areas and toys (followed by rinsing or wiping dry, as instructed (All Purpose Cleaner - Free & Clear | Seventh Generation)). Seventh Generation emphasizes that its cleaners contain no synthetic fragrances or volatile solvents, so there's minimal chemical residue – but the flip side is no lingering antimicrobial effect either. In summary, **Seventh Generation** cleaner provides reliable cleaning of dirt and moderate grease with minimal effort, but for killing bacteria/viruses you must use their separate disinfectant product or another brand's sanitizer. Its performance against grime is sufficient for household upkeep, though perhaps not intended for industrial-strength grease.

Efficacy Summary:

All five products/brands are effective **cleaners**, but their niches differ. **BioNeat NTS-1** distinguishes itself by combining *broad-spectrum cleaning (any washable surface)* with a *unique degreasing prowess* and even some **non-toxic antimicrobial action** (FAQs — Bioneat | The Future of Clean). **Simple Green** and **Seventh Generation** are solid all-purpose cleaners for everyday dirt and grease, but do not actively kill germs (relying on cleaning action alone). **Zep** offers the highest grease-cutting power (with industrial products like Purple) and also has disinfectant options, but one must choose the right product for the job (and handle strong ones carefully). **Ecolab**, as a provider, can meet any efficacy requirement via specialized products – in practice this means very effective cleaning and disinfecting is achievable, but often by using multiple products (a cleaner, then a sanitizer, etc.) rather than one "all-in-one" solution.

BioNeat's **advantage** in efficacy lies in its **versatility and high performance without harsh chemicals** – it can be diluted for light cleaning or used (with water activation) for heavy degreasing, and in both cases it has shown outstanding results (e.g. degreasing an engine or dissolving insect residue) while also knocking down microbial contamination to some degree. Few single products from the compared brands claim to do as much with as little toxicity.

2. Human Safety and Toxicity

BioNeat NTS-1: BioNeat is formulated to be **extremely safe for humans**, to the point of requiring **no hazard warnings** on its labels (FAQs — Bioneat | The Future of Clean) (FAQs — Bioneat | The Future of Clean). According to its Safety Data Sheet, BioNeat NTS-1 has **no significant toxicity or irritancy** in any route of exposure. In testing, it caused *no skin irritation or sensitization*, *no eye irritation beyond mild transient effects*, and *no inhalation toxicity* (All Purpose SDS 9. 06-14-2021.pdf) (All Purpose SDS 9. 06-14-2021.pdf). Ingestion of BioNeat is also essentially non-toxic – the SDS states *"no level of toxicity associated with ingestion"*; if one were to swallow a large quantity, the main effect might be mild gastrointestinal upset or diarrhea due to the product emulsifying fats in the digestive tract (All Purpose SDS 9. 06-14-2021.pdf). This is a remarkable safety profile for a cleaner. It is backed by the fact that **all of BioNeat's ingredients are on the U.S. FDA's GRAS (Generally Recognized As Safe) list** (All Purpose SDS 9. 06-14-2021.pdf), meaning they are ingredients considered safe enough for use in food or ingestible applications. BioNeat contains no solvents, no caustics, no ammonia/chlorine, no phosphates, and no volatile organic compounds (VOCs) (BioNeat NTS™ — Bioneat | The Future of Clean). It's essentially water (>98%) with tiny amounts of natural fatty acids and coconut-based compounds (All Purpose SDS 9. 06-14-2021.pdf). This composition yields an NFPA health hazard rating of 0 (minimal) (All Purpose SDS 9. 06-14-2021.pdf). Independent lab screening for cytotoxicity (cell culture tests per ISO 10993-5) showed BioNeat's diluted solution had **"negligible toxicity"** to mammalian cells, reinforcing that it is gentle on living tissues. In practical terms, users can handle BioNeat without special protective equipment – no gloves or masks required (though any cleaner could sting the eyes, BioNeat is far less irritating than typical detergents). The product emits only a mild soap-like scent and doesn't produce harmful fumes, so it's safe to use in enclosed spaces without ventilation (FAQs — Bioneat | The Future of Clean). This makes it ideal for scenarios like cleaning in confined areas (bathrooms, vehicle interiors) where strong chemical odors or inhalation hazards would be problematic – **"You can**

breathe easy” using BioNeat even for heavy cleaning tasks in a closed bathroom, as the company touts (FAQs — Bioneat | The Future of Clean). Overall, BioNeat NTS-1 exhibits **near-zero acute toxicity** and has no known chronic health hazards. It carries no carcinogen listings, no reproductive toxicity, no neurotoxins, etc., as confirmed by SDS Section 11 (All Purpose SDS 9. 06-14-2021.pdf). This **ultra-safe profile** is a key differentiator: BioNeat is as safe as dish soap or milder – arguably safer, since even dish soaps often carry eye irritant warnings whereas BioNeat does not.

Simple Green: Simple Green’s safety reputation has evolved over time. The current Simple Green All-Purpose Cleaner is **EPA Safer Choice certified**, indicating it meets strict criteria for human and environmental safety (Simple Green | US | Household | All Purpose Cleaner). The formula contains biodegradable surfactants (like an ethoxylated alcohol), citrate builders, and a preservative, with no hazardous dyes or solvents (Simple Green Products SDS). According to its 2014 SDS, it is *“not expected to cause skin or eye irritation”* under normal use, and has no special toxicity warnings (Simple Green Products SDS). In fact, tests showed it was a **“minimal irritant”** or non-irritant in skin and eye assays (no animal testing was done, but in vitro/toxicological profiles indicate low irritancy) (Simple Green Products SDS) (Simple Green Products SDS). Inhalation of Simple Green vapors is not a significant concern since it has very low volatility (no flammable solvents; VOC content essentially zero) (Simple Green Products SDS). Users are generally advised to avoid eye contact (any surfactant can sting eyes) and to wear gloves if handling for long periods or sensitive skin (Simple Green Products SDS), but many people use Simple Green with bare hands without issues. One should not drink it, but if accidentally ingested in small amounts, it’s unlikely to cause more than an upset stomach (the SDS notes “may cause upset stomach” and recommends diluting with water) (Simple Green Products SDS). **Notably, older formulations of Simple Green (pre-2014) contained a solvent called 2-butoxyethanol (aka butyl cellosolve)**, which raised toxicity concerns (it can cause red blood cell damage and is a skin/eye irritant at higher exposures) (Some of the Worst Cleaning Products) (Simple Green cleaners: Critics say it isn't green). That ingredient led to criticism that Simple Green’s “non-toxic” claims were misleading in the past. However, the company appears to have removed butoxyethanol in the current formula – the listed ingredients now are all low-toxicity components (the main surfactant is an alcohol ethoxylate which, while it can be a mild irritant, is far less hazardous). Thanks to these changes, Simple Green is much safer than it used to be, and its **Safer Choice** status confirms no carcinogens or reproductive toxins are present. The EPA’s technical listing for Simple Green even stated: *“Safe for use on skin and will not cause irritation in the majority of users”*, requiring only standard eye protection if splashing is likely (SIMPLE GREEN® | US EPA). It also mentioned **“no special precautions or additional protective equipment are required”** during use, aside from common-sense eyewash availability for potential eye contact (SIMPLE GREEN® | US EPA). In summary, **Simple Green poses little human health hazard**: it’s non-flammable, non-corrosive, and free of toxic fumes. The biggest safety consideration is to keep it out of eyes and not to mix it with other chemicals (as with any cleaner). The product is sold to consumers with labeling like “non-toxic†” and “biodegradable,” and while “non-toxic” is a broad term, in normal usage Simple Green will not cause harm. (One caveat: any surfactant cleaner, including Simple Green, if swallowed in large quantity by a small child could cause nausea and possibly more serious effects – so “keep out of reach of children” still applies. But it does not contain highly poisonous ingredients like bleach or phenols that some cleaners have.)

Zep: The **human safety** of Zep products varies dramatically by which product is considered. **Zep's aggressive degreasers** (e.g. Industrial Purple) are **hazardous**: they are classified as **corrosive to skin and eyes** due to high alkalinity (pH >13) and can cause chemical burns on contact (Fireside Rides, Llp | Occupational Safety and Health Administration ...). Such products carry **DANGER** labels, and OSHA explicitly identifies Zep Purple as a corrosive hazard in workplace safety citations (Fireside Rides, Llp | Occupational Safety and Health Administration ...). Users must wear rubber gloves, eye protection, and sometimes even face shields and aprons when handling these concentrates. Inhaling mists or spray of the strong products can irritate or damage respiratory passages. Thus, while these Zep cleaners excel at cleaning, they are **not "user-friendly" or safe** in the way BioNeat or Seventh Generation are. They are intended for professional use with proper training. On the other hand, **Zep's greener/safer products** (like the GreenLink line mentioned earlier) are designed to be much safer. The **Zep Multi-Clean Green** cleaner, for instance, is non-toxic and non-carcinogenic, with no hazardous ingredients; it's classified as non-hazardous waste (RCRA) and meets Green Seal's strict health criteria (Multi-Clean Green – Zep Inc.) (Multi-Clean Green – Zep Inc.). One interesting note: even that product has a Proposition 65 warning for trace contaminants like 1,4-dioxane and ethylbenzene (likely at extremely low levels as impurities in surfactants) (Multi-Clean Green – Zep Inc.). This shows that even safe formulas can have minute traces of problematic substances – but practically, the exposure is negligible and the product is considered safe to use without special precautions. Most of Zep's consumer retail products (all-purpose sprays, bathroom cleaners, etc.) fall somewhere between these extremes. They often contain detergents, glycol ether solvents, or mild acids and carry at least a *"Caution"* or *"Warning"* label (e.g. "may cause eye irritation, use in well-ventilated area, etc."). For example, Zep's tub and tile cleaners may contain lactic or citric acid (eye irritant), and some all-purpose cleaners might contain butoxyethanol or ammonia in small amounts (requiring ventilation and gloves for sensitive individuals). **In summary:** As a brand, **Zep includes both hazardous and relatively safe products**, so one must check the specific SDS. If we compare **like for like** (general-purpose cleaners), a Zep all-purpose cleaner typically is moderate in safety – perhaps a slight irritant and requiring common-sense care. If we compare **top degreasers**, BioNeat NTS-1 is dramatically safer than Zep's strongest degreasers (which can burn skin and must not be inhaled). Zep's *safest* offerings (GreenLink) approach BioNeat in low toxicity but still might not reach the "no warnings at all" level that BioNeat has. For instance, Zep GreenLink carries no toxicity warnings aside from Prop 65 (which is more a regulatory formality for trace chemicals) and is stated to be *"non-toxic"* (Multi-Clean Green – Zep Inc.). Zep does ensure none of their products contain methylene chloride or other banned toxic solvents in consumer lines, but some do have high VOCs (like aerosol brake cleaners, etc., which are part of their automotive lineup). Overall, **user safety** is an area where Zep's strongest cleaners lag far behind BioNeat and Seventh Gen – they require precautions and carry risk of injury if misused.

Ecolab: Ecolab's products run the gamut from very safe to quite hazardous, depending on purpose. For **institutional cleaners** (like daily floor cleaners, general kitchen cleaners), Ecolab often formulates concentrates that, at in-use dilution, are relatively safe (low irritancy). However, the concentrates themselves can be classified as irritants. Ecolab mitigates risk by providing **closed-loop dispensing systems** for many of its concentrates – workers don't directly handle the raw chemical; it's dispensed via a machine into a dilute solution, reducing splashes and fumes. This was highlighted as a safety innovation by Ecolab: a dispensing system that *"reduces*

packaging waste and simplifies on-site dilution", improving worker safety (Ecolab Inc. - Ecolab Recognized as EPA Safer Choice Program Partner of the Year). Many Ecolab cleaning agents carry an OSHA *"Warning"* for eye irritation, since even a neutral pH surfactant can irritate eyes if splashed. For example, a typical Ecolab all-purpose cleaner SDS might say "Avoid contact with eyes. In case of contact, rinse thoroughly" – similar to Simple Green's precautions. **Disinfectants and heavy-duty cleaners from Ecolab**, on the other hand, can have hazards: e.g. Ecolab quaternary disinfectants are often skin irritants (require gloves), peracetic acid-based cleaners are corrosive and cause respiratory irritation (users must wear protective gear and ensure ventilation when using something like OxyCide due to its strong vinegar-like fumes). Caustic oven cleaners from Ecolab will have burn hazards like Zep's. So, **worker safety** is managed through training and PPE in commercial settings. Ecolab is known for its extensive safety data and training – they provide wall charts, manuals, and onsite training to ensure proper use, acknowledging that some of their solutions need careful handling. Importantly, **Ecolab has made efforts to develop safer chemistry alternatives** in recent years. They have a line of products that achieved EPA Safer Choice certification or similar standards, especially for their customers who prioritize sustainability. (Ecolab was even recognized as an EPA Safer Choice **Partner of the Year** for formulating safer products and advancing chemical safety (Ecolab Inc. - Ecolab Recognized as EPA Safer Choice Program Partner of the Year).) This indicates that Ecolab can formulate products that avoid the worst hazardous ingredients. For example, an Ecolab glass cleaner might use ethanol and a biodegradable detergent – flammable but low toxicity – instead of ammonia, to reduce fumes. Or an Ecolab degreaser for floor mopping might use lower alkalinity plus enzymes to avoid harsh chemicals. Additionally, by EU law, all detergents Ecolab sells in Europe have only biodegradable surfactants and no toxic phosphates, etc., meaning baseline chemical safety is considered (Ecolab SDS often state: "the surfactants contained in the product are biodegradable according to regulation 648/2004/EC" ([PDF] Mip SM - Ecolab)). In general, **Ecolab's approach to safety is to tailor the product to professional users**: if a job requires a hazardous chemical (e.g. a strong acid descaler for industrial equipment), Ecolab supplies it but also supplies the training and equipment to use it safely. For more routine cleaning, Ecolab provides products that are about as safe as consumer cleaners (sometimes even identical in ingredients).

For a direct **consumer vs BioNeat** perspective: Ecolab doesn't really market to individual consumers, but if one were to use an Ecolab all-purpose cleaner (say from their Oasis Pro line) at home, it would likely have a "use gloves, keep out of eyes" warning and a caution to not ingest – standard for cleaning products. It wouldn't be as worry-free as BioNeat (which practically you could wash your hands with in a pinch). However, Ecolab's safe products are still quite benign. For example, Ecolab's **Peroxide Multi-Surface Cleaner** (which is used in hospitals for both cleaning and some sanitizing) is stated to be "readily biodegradable" and, at use-dilution, not harmful; it does require gloves and eye protection when handling concentrate because of the hydrogen peroxide content ([PDF] SAFETY DATA SHEET DAILY DISINFECTANT CLEANER - Ecolab). So **safety-wise**, Ecolab products range from *green and safe* to *corrosive and dangerous*, with many in between. The company emphasizes proper use to mitigate these risks.

Seventh Generation: Seventh Generation's products are designed with human health in mind. The All-Purpose Cleaner is **water-based and plant-derived**, with no synthetic fragrances or dyes, and the preservatives are used at very low levels. The result is a product that is generally

very safe to use. It is certified by the EPA Safer Choice program, indicating it has met high standards for safety (e.g. no known carcinogens, mutagens, or reproductive toxins, low skin/eye irritation potential, etc.) (All Purpose Cleaner - Free & Clear | Seventh Generation). It's also a USDA Certified Biobased 95% formula (Seventh Generation® Professional 44720EA All-Purpose Cleaner ...), meaning the bulk of its ingredients are renewable and typically those tend to be less toxic. For everyday handling, Seventh Gen All-Purpose Cleaner only really requires basic caution: avoid splashing it in your eyes and maybe rinse your hands after use if skin is sensitive (because even mild surfactants can defat the skin with prolonged contact). The product is marketed as **"Safe for use around kids and pets"** (All Purpose Cleaner - Free & Clear | Seventh Generation) – this implies it's free from ingredients that could cause acute harm if, say, a child touches a cleaned surface and then their mouth. Indeed, there are no harmful residues left behind; the formula has no ammonia, no chlorine bleach, no phenolic antimicrobials, etc. If a pet walked on a surface cleaned with Seventh Gen and then licked its paws, it's unlikely to suffer any ill effect (perhaps a soapy taste at most). The Seventh Gen SDS classifies it as **not hazardous under OSHA/WHMIS** definitions (SDS-FM000011-01-1-All-Purpose-Cleaner-FrMrngMdw-EN-2018-10-19). Its pH is around neutral to slightly alkaline (because of sodium citrate and a little sodium carbonate), but not enough to burn skin. Users typically do not need gloves or ventilation when using it – there are no fumes (free of VOC solvents; even the scented versions use essential oils in small amounts). The **preservatives (methylisothiazolinone and benzisothiazolinone)** are perhaps the one health consideration: a small percentage of people are allergic to isothiazolinones. Seventh Gen uses very low concentrations (under 0.01%), but if someone is extremely sensitive, repeated skin contact could cause an allergic rash. This is true for many "mild" cleaners and even some personal care products, as these are among the few effective broad-spectrum preservatives allowed in Safer Choice products. Aside from that specific allergy concern, there are no significant toxicity issues. Ingesting the cleaner is not advised, but if a toddler accidentally got some in their mouth, the outcome would likely be just an unpleasant taste and maybe minor stomach upset – the ingredients (mainly decyl glucoside, lauryl ethoxylate, citrate, and food-grade citric acid) are of low toxicity. Seventh Generation's ethos is to **minimize chemical hazards**, and it shows: they openly disclose ingredients and have been rated highly by third-party assessments like EWG for many of their products. The cleaner is *Leaping Bunny certified* (no animal testing) (All Purpose Cleaner - Free & Clear | Seventh Generation) and generally considered a top-tier "green" product in terms of safety.

Safety Summary:

BioNeat NTS-1 leads in safety: it is essentially harmless to users (no PPE needed, no toxic exposure risk) (All Purpose SDS 9. 06-14-2021.pdf) (All Purpose SDS 9. 06-14-2021.pdf). **Seventh Generation** and **Simple Green** are also very safe for household use, though a bit more caution is warranted (they can irritate eyes, and one might wear gloves if skin is sensitive, but overall they are not harmful with normal use). **Ecolab** and **Zep** each have a dual nature: they offer safer cleaners but also sell potent chemicals that require significant precautions. For a non-professional user, BioNeat and Seventh Gen are the kind of products you can use without second thought about health, whereas with Zep you must choose carefully (use their gentler lines for safety, or accept the risks of their heavy-duty products with proper protection). BioNeat's **unique differentiator** in safety is evidenced by statements like *"no warning label of any kind is required by any federal, state, or municipal agency"* (FAQs — Bioneat | The Future of

Clean) (FAQs — Bioneat | The Future of Clean) – an extraordinary claim that is supported by the GRAS-status ingredients and its testing. This contrasts starkly with, say, a drum of Zep Purple which would have multiple hazard pictograms (corrosive, acute toxicity if swallowed, etc.). Even compared to Simple Green, which is labeled "Keep out of reach of children" and "may irritate eyes," BioNeat's complete lack of warnings is noteworthy.

3. Environmental Impact (Marine & Aquatic)

BioNeat NTS-1: BioNeat was developed with environmental safety as a priority. It is **fully biodegradable** and non-polluting. The surfactants in NTS-1 are derived from natural fats/oils and are readily broken down by microbes. BioNeat's SDS explicitly states *"Contains biodegradable surfactants"* and that there is **"no known ecotoxicity associated with this product."** (All Purpose SDS 9. 06-14-2021.pdf). In other words, in tests or evaluations, BioNeat did not exhibit toxic effects on aquatic organisms. The product was tested for aquatic toxicity in accordance with EPA methods and met the criteria for safety – the BioNeat technical info indicates it complies with *EPA 821/R-02-012* guidance for aquatic toxicity (BioNeat NTS™ — Bioneat | The Future of Clean). This suggests that the LC50 (lethal concentration 50%) for fish or other test organisms is high enough that BioNeat would not be classified as harmful to the aquatic environment. Indeed, when BioNeat breaks apart oil and grease, it actually renders those hydrocarbons more biodegradable as well, potentially aiding bioremediation. The absence of persistent chemicals (no phosphates, no chlorine, no nonylphenol ethoxylates, etc.) means it does not contribute to problems like eutrophication or endocrine disruption in wildlife. BioNeat also contains **no VOCs or ozone-depleting substances** (BioNeat NTS™ — Bioneat | The Future of Clean), so it does not contribute to smog or air pollution. In marine settings, BioNeat can be directly applied to oil spills to help disperse and degrade the oil, as it is essentially a *colloidal surfactant bioremediation aid*. Because it is highly water-soluble and non-bioaccumulative, it dilutes out and biodegrades after use without leaving harmful residues. The product was evaluated in 2014 for biodegradation; while that specific test was on a formulation with a certain ingredient (MEA) that the new formula lacks, the expectation is that the current MEA-free formula is *at least as biodegradable* (FAQs — Bioneat | The Future of Clean). BioNeat has **no bioaccumulative potential** (its ingredients either mineralize to CO_2 and water or are natural minerals like sodium bicarbonate in trace amounts). Furthermore, disposal of BioNeat is straightforward: unused concentrate can be diluted and rinsed down the drain without special treatment, since it's not regulated as hazardous waste (All Purpose SDS 9. 06-14-2021.pdf). For industrial users, this means less worry about effluent toxicity – BioNeat in wash water should easily meet wastewater discharge standards given its low aquatic toxicity and full biodegradability. In summary, BioNeat NTS-1 is designed to be **environmentally benign** in both freshwater and marine ecosystems. Its manufacturer positions it as *"industrially clean, environmentally green"*, which is supported by the product containing only **safer, renewable-resource ingredients** (BioNeat NTS™ — Bioneat | The Future of Clean).

Simple Green: Simple Green's environmental profile is generally positive, especially after reformulation. It is **biodegradable** – its organic components pass OECD tests for ready biodegradability (the SDS notes "Readily Biodegradable per OECD 301D, Closed Bottle Test" (Simple Green Products SDS)). This means within a few weeks, the surfactants break down substantially in the presence of water and microbes. Earlier formulas of Simple Green had some

issues: the presence of 2-butoxyethanol and a surfactant (nonylphenol ethoxylate) that can be harmful to aquatic life was a concern raised by environmental groups. Nonylphenol ethoxylates, in particular, are known to degrade into endocrine-disrupting compounds toxic to fish. However, **Simple Green no longer contains nonylphenol ethoxylates** – it uses an alcohol ethoxylate and sugar-based surfactant now, which are both on the Safer Choice approved list for aquatic safety. The aquatic toxicity data for current Simple Green are quite mild: an independent assessment found the "volume of ingredients used does not trigger toxicity classifications" under GHS, and specific tests showed **low aquatic toxicity (EC50 ≥ 100 mg/L)** for algae, daphnia, etc. (Simple Green Products SDS). That places it in a relatively harmless category (for context, substances with EC50 >100 mg/L are often considered practically non-toxic to aquatic organisms). Additionally, the EPA's listing for Simple Green as a surface washing agent includes toxicity results: **LC50 of 27.9 ppm for fish and 77.6 ppm for shrimp (Mysid)** (SIMPLE GREEN® | US EPA). Those numbers indicate moderate toxicity at high concentrations – meaning if Simple Green concentrate were released in a small volume of water, it could harm aquatic life, but at typical environmental dilutions it's unlikely to reach those levels. Notably, those values were an improvement over crude oil itself (which had LC50 around 6 ppm for fish) (SIMPLE GREEN® | US EPA), and when Simple Green was mixed 1:10 with oil, the toxicity of the oil was reduced. Simple Green contains *no* heavy metals, and no persistent organics – nothing that would bioaccumulate in the food chain. It's also free of phosphorus, so it doesn't contribute to algal blooms. The **EPA Safer Choice** certification further attests that its ingredients each pass strict environmental toxicology criteria (for example, any aquatic toxicity must be at very low concern levels for a chemical to be allowed in a Safer Choice product). In marine environments, Simple Green has been used for cleaning oil from wildlife and rocks, suggesting that it's one of the more benign choices available (though any cleaner in a pristine environment should still be used sparingly). One caution from the SDS: it says *"Avoid release into open waterways and storm drains"* in pure form (Simple Green Products SDS). This is a standard caution for any detergent – large amounts can cause foaming and temporarily affect aquatic organisms' gill function if not diluted. But once it enters a sewage treatment or spreads out in a large water body, it will biodegrade and dilute. Simple Green's packaging is also often recyclable, and the company (Sunshine Makers, Inc.) emphasizes environmental responsibility (they were early to market with a "safer" cleaner decades ago). Overall, **Simple Green is considered environmentally safe** when used as directed, with rapid biodegradation and *minimal environmental persistence*. It's not perfectly "edible" to the environment, but in comparison to solvent cleaners or harsh chemicals, it's a very green option.

Zep: Because Zep's product range is broad, environmental impact must be considered product by product. Zep's **traditional/industrial cleaners** can contain ingredients that are less eco-friendly, whereas their **"GreenLink" environmentally preferred** products are designed to minimize environmental harm. Starting with the worst-case scenarios: Zep's heavy-duty cleaners might have high pH which, if discharged untreated, could harm aquatic life (very alkaline water can kill fish and aquatic organisms). They may also contain solvents like butoxyethanol or petroleum distillates that are toxic to aquatic organisms and not readily biodegradable. For example, if one used Zep's purple degreaser and rinsed it into a storm drain, the sudden high pH and surfactant load could harm organisms in a creek. Also, some Zep formulations may contain chelating agents like EDTA or NTA – these are persistent in the environment (EDTA, for instance, is not readily biodegradable and can mobilize heavy metals in

water). However, Zep has been moving toward more eco-friendly formulas in response to market demand and regulations. Their **Zep GreenLink Multi-Clean Green** has a very good environmental profile: it is Green Seal certified, meaning it had to meet criteria for toxicity to aquatic life, biodegradability, and minimized VOCs (Multi-Clean Green – Zep Inc.) (Multi-Clean Green – Zep Inc.). Green Seal's GS-37 standard requires that products be *readily biodegradable*, *non-toxic to aquatic life* at use dilution, *concentrated to reduce packaging*, and *not contain hazardous ingredients* like phthalates or ozone-depleters. So any Zep product with Green Seal or Safer Choice labels can be trusted to be low-impact. Zep also has some products certified for "Direct Release" by Safer Choice (like the pressure wash mentioned) which is specifically meant for outdoor use where runoff goes directly to the environment (ZEP 172 oz. All-in-1 Pressure Wash ZUPPWC160 - The Home Depot). Those products must pass even stricter aquatic safety tests, meaning they cause no significant harm even when released untreated into streams. We can glean that such formulations avoid highly toxic surfactants or solvents; they likely use things like alcohol ethoxylates that biodegrade and maybe citrus terpenes in low amounts, etc. On the other hand, some Zep products contain quaternary ammonium compounds (in disinfectants) – quats are known to be toxic to aquatic life (they can kill algae and aquatic invertebrates at low ppm and tend to sorb to sediment). Without treatment, quat-containing cleaners should not be released to waterways. But in controlled settings (e.g. a floor is mopped with a Zep disinfectant and the wastewater goes to a sewage plant), the impact is mitigated by treatment and binding to biosolids. **VOC emissions**: Many older solvent-based degreasers from Zep have high VOC content (e.g. aerosol cleaners with toluene or acetone). These contribute to ground-level ozone (smog) formation. Zep has been reformulating to comply with regulations, but some solvent products are still on the market. BioNeat and Seventh Gen have zero or near-zero VOC; Simple Green is also essentially zero VOC (Simple Green Products SDS), whereas Zep's solvent cleaners might have a significant VOC percentage. Zep does offer low-VOC alternatives as well. Packaging and concentration: Zep sells concentrates in large drums for industrial use, which reduces packaging waste per use, but also sells many ready-to-use plastic spray bottles. The company has not been as vocal as Seventh Generation about post-consumer recycled packaging or such, but they do have recycling info for their containers, and their aerosol cans are steel which is recyclable.

In a scenario of **marine impact**: If an accident spilled a large quantity of a strong Zep cleaner into a river, one could expect fish kills or environmental damage unless promptly diluted – for example, a spill of Zep's alkaline degreaser could raise the pH of water dangerously high locally, and the surfactants/solvents could poison aquatic life. BioNeat or Seventh Gen spilled in the same way would have far less severe impact (BioNeat is near neutral pH and non-toxic, Seventh Gen similarly). But if a user sticks to Zep's environmentally preferred products, those are tested to ensure minimal aquatic toxicity (GreenLink Multi-Clean Green is stated as "non-toxic" and likely has no harmful effect at typical environmental concentrations). So **Zep's environmental impact ranges from moderate concern (for their harsh products) to low concern (for their green products)**. The presence of any non-biodegradable ingredients in some Zep formulas (e.g. silicones, certain polymers, or harsh inorganic components) means some Zep products might leave persistent residues. Yet, as a company, Zep Inc. is mindful of compliance and product stewardship – they wouldn't intentionally include something that's an outright environmental hazard without disclosures. It's just that their product line covers needs where

sometimes the performance outweighs the environmental friendliness (heavy-duty cleaning in industrial context often means using caustic or solvent).

Ecolab: Ecolab, due to its scale and working in regulated industries, generally ensures its products are not environmentally harmful when used as directed. Many Ecolab cleaning agents end up in wastewater that goes to treatment plants; thus, Ecolab selects surfactants that are biodegradable and ingredients that won't upset treatment processes. In fact, as mentioned, Ecolab's products in Europe comply with the EU Detergent Regulation which mandates **ultimate biodegradability of surfactants** ([PDF] Mip SM - Ecolab). Ecolab often uses ingredients like alcohol ethoxylates, alkyl polyglucosides, citric acid, etc., which are environmentally acceptable. Furthermore, Ecolab has **invested in greener chemistry**: for instance, they have a line of solid capsule detergents that reduce shipping weight and packaging, and some products with third-party eco-certifications (Green Seal or ECOLOGO) for institutional cleaners. The recognition by EPA Safer Choice (Partner of the Year 2016) indicates Ecolab has worked on formulations with *inherently safer and greener profiles* (Ecolab Inc. - Ecolab Recognized as EPA Safer Choice Program Partner of the Year). One example given was their partnership with a retailer to create Safer Choice-certified store-brand cleaners (Ecolab Inc. - Ecolab Recognized as EPA Safer Choice Program Partner of the Year), showing they can formulate to those standards.

However, not all Ecolab products are benign – many are **sanitizers/disinfectants** that contain biocides. Quaternary ammonium compounds, chlorine (bleach) releasing agents, peracetic acid, etc., are part of Ecolab's arsenal for hospitals and food safety. These chemicals can harm aquatic environments if released in quantity. But typically, they are used in controlled settings (e.g. a hospital's disinfectant effluent is small and gets processed; a food plant's sanitizers get diluted and neutralized). Ecolab's safety data on a quaternary disinfectant might note it's "poorly biodegradable" and toxic to fish (for example, one Ecolab Neutral Disinfectant SDS shows it's "Poorly biodegradable. Bioaccumulative potential: no data" ([PDF] SAFETY DATA SHEET DAILY DISINFECTANT CLEANER - Ecolab), and likely it has warnings about environmental release). Regulatory compliance usually requires that industrial users neutralize or sufficiently dilute such solutions before discharge. Ecolab often helps clients with environmental compliance as part of their service (like monitoring discharge from clean-in-place systems).

In **marine contexts**, Ecolab products aren't typically used directly on open water, except possibly some dispersants or cleaners for ship hulls. Ecolab does produce some environmentally-friendly ship cleaning products (through their Nalco Water division) but that's niche. In general, **Ecolab's environmental impact is managed through design (biodegradability, concentration to reduce shipping), compliance (making sure toxic ingredients are used only where necessary), and innovation (like developing non-toxic alternatives)**. For instance, Ecolab introduced a solvent-free degreaser for machinery that works with a biodegradable ester instead of hazardous solvents – reducing VOCs and aquatic toxicity. And in water treatment, Ecolab aims to reduce chemical oxygen demand and pollutant load by optimizing processes.

Because Ecolab serves many food processing plants, their cleaners often have to be **acceptable for discharge to municipal wastewater**. They even have some products that meet USDA BioPreferred requirements (though they might not always market that).

Seventh Generation: Seventh Generation is known for its **environmentally conscientious products**. The All-Purpose Cleaner is no exception: it is made of **95% biobased ingredients** and carries the USDA Certified Biobased label (Seventh Generation® Professional 44720EA All-Purpose Cleaner ...). All organic ingredients are **readily biodegradable** (the surfactants like decyl glucoside and laureth-6 biodegrade quickly and completely; citric acid and sodium citrate are part of natural biochemical cycles). The product has **no ammonia, no chlorine, no synthetic dyes** – so it avoids discharging any toxicants that could bioaccumulate or persist. Seventh Gen also avoids phosphates, and their detergents use sodium gluconate or citrate as water softeners instead of EDTA, to ensure ultimate biodegradability. They often design products for **greywater and septic safety**, meaning if you dump a bucket of used Seventh Gen cleaner water on your lawn or into a septic system, it won't harm the useful bacteria or environment. The company's FAQ clarifies that their surface cleaners contain no VOCs except potentially the essential oil fragrances (the Free & Clear version has none) (All Purpose Cleaner - Free & Clear | Seventh Generation). That means negligible contribution to air pollution. In aquatic toxicity terms, Seventh Generation aims for ingredients that are low toxicity to fish and aquatic invertebrates. Decyl glucoside, for instance, has low acute toxicity to algae/fish (usually LC50 >100 mg/L), and the other ingredients similarly are low concern. Methylisothiazolinone (MIT) is actually toxic to fish in high concentrations, but because it's present at <0.01%, the overall formula likely meets Safer Choice thresholds for aquatic safety (Safer Choice limits the allowed dose of MIT to ensure effluent concentrations stay below toxic levels). The product is also used in small quantities typically, and once diluted in waste water, the preservatives are further diluted and rapidly degraded (MIT breaks down under sunlight and in sewage treatment fairly well). Seventh Generation is often very transparent with environmental info – for example, they publish that their all-purpose cleaner has a Life Cycle Assessment showing reduced carbon and water footprint compared to conventional cleaners. Also, the packaging is environmentally friendly: Seventh Gen uses 100% recycled plastic bottles for many products and encourages recycling.

In a **marine setting**, if Seventh Gen cleaner were used on a boat and some went overboard, its impact would be minimal and the surfactants would biodegrade in seawater (glucosides biodegrade in saltwater too). It's certainly a product one could feel okay about rinsing into the sink; it won't cause issues at the wastewater treatment plant or downstream. The main message is that **Seventh Generation's product is designed to be as close to environmentally neutral as a cleaner can be**: it's *EPA Safer Choice certified* for environmental and health safety (All Purpose Cleaner - Free & Clear | Seventh Generation), and *Biopreferred*, and the brand's ethos is preventing pollution. They avoid any ingredient that is toxic to aquatic life by design (for example, they don't use alkylphenol ethoxylates or phthalates or optical brighteners, all of which can be problematic). So its environmental impact is **very low**.

Environmental Impact Summary:

All these products are intended to be disposed of down the drain, so their effect on water and ecosystems is important. **BioNeat NTS-1** is outstanding in this regard: it is fully biodegradable and was shown to have *no harmful impact on aquatic organisms*, making it safe for direct release scenarios (All Purpose SDS 9. 06-14-2021.pdf). It is also effective in oil spill cleanup without adding new pollutants, as it contains no priority pollutants or persistent toxins. **Seventh Generation** and **Simple Green** are also highly biodegradable and relatively non-toxic to aquatic

life; they are safe for septic systems and generally meet or exceed standard environmental regulations for cleaners (e.g., phosphate-free, no hazardous waste classification (All Purpose SDS 9. 06-14-2021.pdf) (Multi-Clean Green – Zep Inc.)). **Ecolab** products, depending on which, can be environmentally safe (especially those with Safer Choice or designed for sustainability) or can contain some chemicals of concern (e.g. sanitizers that require careful handling of effluent). However, Ecolab manages this by controlling use concentrations and advocating proper disposal – and importantly, **all surfactants in Ecolab detergents are biodegradable** by rule ([PDF] Mip SM - Ecolab). **Zep** again spans the range: their GreenLink line is on par with Seventh Gen/Simple Green in eco-friendliness (biodegradable, low toxicity), while some classic Zep formulas (solvent-based degreasers, strong caustics) would pose environmental hazards if mishandled. Zep does have certain products with VOCs that contribute to air pollution, whereas BioNeat, Seventh Gen, and current Simple Green are essentially VOC-free.

A notable unique point: BioNeat's formulation is so benign that even its **unused concentrate** is *not classified as hazardous waste* under EPA rules (All Purpose SDS 9. 06-14-2021.pdf). Many industrial cleaners (including some from Zep/Ecolab) in concentrate form might be considered corrosive waste or ignitable due to solvents. BioNeat users don't face that issue. Additionally, BioNeat's lack of synthetic chemicals means **no strange breakdown byproducts** – for instance, some cleaners when biodegrading can form low levels of nitrosamines or other byproducts if they had certain amines or such; BioNeat's ingredients (fatty acids, coconut oil, baking soda) simply break down to carbon dioxide, water, and benign salts.

In marine/aquatic environments, **BioNeat and Seventh Generation are the most "aquatic-safe"** – one is specifically noted to meet aquatic toxicity standards (BioNeat NTS™ — Bioneat | The Future of Clean), and the other is Safer Choice Direct Release eligible (Seventh Gen actually sells a Marine cleaner for boats that likely uses similar chemistry). **Simple Green** has a long history of being used in sensitive environments (for example, it has been used by the military for aircraft cleaning that can run off to tarmac drains), though it had some past critique, it is now also Safer Choice and demonstrated to be low aquatic toxicity in independent tests (Simple Green Products SDS). **Zep** requires caution: choose their green products for minimal impact, as some others could harm the environment if not handled properly. **Ecolab** overall strives for environmental stewardship, but because they cover heavy-duty sanitation, some of their necessary biocides are inherently not eco-friendly (however, usage of those is typically in controlled closed systems, not open environment).

BioNeat's differentiator: it offers **industrial-grade cleaning with negligible environmental footprint**, potentially replacing harsher cleaners that pose disposal problems.

4. Certifications and Recognitions

This section compares official **certifications and compliance** labels held by BioNeat NTS-1 and the four brands' products, such as **EPA Safer Choice**, **USDA BioPreferred (BioBased)**, **OMRI (Organic Materials Review Institute)**, **EPA or FDA approvals**, etc., as well as standards compliance.

- **BioNeat NTS-1:** BioNeat NTS-1 has earned the **EPA Safer Choice** label (BioNeat NTS™ — Bioneat | The Future of Clean) (BioNeat NTS™ — Bioneat | The Future of Clean). (On the product webpage, they note: "*EPA Safer Choice does not constitute endorsement… The Safer Choice label signifies that BioNeat NTS-1 contains ingredients with more positive human health and environmental characteristics than conventional products of the same type.*" (FAQs — Bioneat | The Future of Clean).) This certification means EPA's scientists reviewed each ingredient and found them among the safest in their class, and that the product meets performance requirements. Achieving Safer Choice is significant, as many cleaning products (especially industrial ones) do not have this. BioNeat also complies with **USDA's food-safe categories A1 and L1** for cleaning compounds (BioNeat NTS™ — Bioneat | The Future of Clean). *A1* means it's a general cleaner acceptable in food processing areas (on surfaces not contacting food directly, or contacting food with a proper rinse) and *L1* indicates it's suitable as a drain or sewer cleaner in food plants – essentially showing USDA (formerly through NSF registration) found it safe for use in regulated meat/poultry facilities (BioNeat NTS™ — Bioneat | The Future of Clean). This is akin to an NSF registration (NSF took over USDA's authorization program) for nonfood compounds, which is a valuable certification for selling to food industry. BioNeat is **USDA BioPreferred?** – It is not explicitly stated if they have the USDA Certified Biobased label. However, given its formulation (almost entirely biobased ingredients), it likely could qualify for that certification. Many products apply for it to display the percentage of biobased content. If not officially done yet, it remains an avenue. BioNeat's SDS did mention **"all components are on FDA's GRAS list"** (All Purpose SDS 9. 06-14-2021.pdf), which while not a consumer-facing certification, is a strong indicator of safety (and could be leveraged for something like **FDA approval for incidental food contact** – e.g. cleaners in food establishments, which typically require either being rinsed or being made of GRAS food-grade ingredients if no rinse). It appears BioNeat uses that GRAS fact to underscore why no warnings are needed (FAQs — Bioneat | The Future of Clean) (FAQs — Bioneat | The Future of Clean). As for **OMRI**, BioNeat is not specifically listed as OMRI certified, but since it contains only natural-derived substances and no synthetic dyes/fragrances, conceivably it could qualify for OMRI listing if the company pursued it (OMRI would allow many soaps and cleaners as long as they meet certain criteria, for use in organic farming operations). **Kosher/Halal** are sometimes relevant for cleaners in food industries; not sure if BioNeat has those, but it does avoid animal-derived ingredients so it could be acceptable in vegan contexts. There's also mention that BioNeat complies with OSHA and EPA standards (HazCom and VOC regulations) (BioNeat NTS™ — Bioneat | The Future of Clean) – which is expected but good to note. They also mention compliance with *40 CFR Ch.1 Subpart C&D* (which pertains to environmental regulatory compliance, likely TSCA and RCRA stuff) and the product's components are listed on EPA's TSCA Inventory (all commercial chemicals must be, and SDS confirms that) (All Purpose SDS 9. 06-14-2021.pdf). Overall, BioNeat's key certifications: **EPA Safer Choice** (achieved), **USDA A1/L1 (NSF)** (achieved), and implicitly **FDA GRAS components**. It likely also passes standard OECD tests (the manufacturer references a 2014 biodegradability study, albeit on an older formula) (FAQs — Bioneat | The Future of Clean). It's noteworthy that BioNeat emphasizes third-party lab tests in its literature (for efficacy and safety), which, while not "certifications," provide validation (discussed in section 5).

- **Simple Green:** Simple Green's All-Purpose Cleaner is **EPA Safer Choice Certified** as well (Simple Green | US | Household | All Purpose Cleaner). This is a relatively recent development (earlier in the 2000s it was not certified due to that butoxyethanol content, but after reformulation it qualified). The Safer Choice standard assures that every ingredient, including colorants and preservatives, meet safety criteria for people and the environment. So Simple Green can bear the Safer Choice logo on its label (and indeed Home Depot listings highlight it as Safer Choice Certified (Simple Green 1 Gal. Concentrated All-Purpose Cleaner)). Simple Green is also part of some governmental purchasing lists as an environmentally preferable product. Historically, Simple Green was advertised as "non-toxic, biodegradable" even before third-party labels existed; now it has the official backing of Safer Choice. **USDA BioPreferred:** Simple Green has not prominently displayed a USDA biobased label, which suggests they may not have applied for it. The product is water plus mostly petrochemical-derived surfactant (though could be plant-derived alcohol feedstock, it's not specified) and a bit of plant-based content (citrate). Possibly the bio-based content is not extremely high – maybe around 50% or so – but this is speculative. Without a clear claim, we assume it's not certified BioPreferred. **Green Seal or EcoLogo:** Simple Green All-Purpose is *not* Green Seal GS-37 certified (Green Seal did not certify it, possibly because of past formula or because the company did not seek it). However, Simple Green does have some products certified by other bodies: their *Crystal Simple Green* (fragrance-free version) is NSF registered for use in food processing facilities (Category A1) – meaning it's been reviewed by NSF and meets USDA's requirements for safety in those environments. Also, Simple Green has some specialty products that are NSF certified for drinking water system cleaning, etc. The **NSF A1 registration** is analogous to what BioNeat has (USDA A1). Simple Green is also on some **federal procurement lists** as environmentally preferable (it might not have an OMRI or direct FDA GRAS claim though). **Leaping Bunny/animal testing:** Simple Green doesn't test on animals as far as known, but they aren't known for having a Leaping Bunny or PETA certification like Seventh Gen does. **ISO certifications:** The manufacturer Sunshine Makers likely has ISO 9001 and 14001 for quality and environmental management, though that's not a consumer label, it's an internal standard. There was an interesting certification: Simple Green was listed on the EPA's National Contingency Plan Product Schedule (as a Surface Washing Agent) which we saw in the EPA technical bulletin (SIMPLE GREEN® | US EPA). While not a certification per se, it's an EPA listing that requires effectiveness and toxicity data submission. Being on that list means it met EPA's criteria for use in oil spill response, which is a form of validation for environmental safety in sensitive conditions.

- **Zep:** Zep as a company has a variety of products with certifications:

    - **EPA Safer Choice:** Yes, Zep has a number of Safer Choice-certified products. For example, their **All-in-1 Pressure Wash** and some **Zep Commercial** products like certain all-purpose cleaners carry the Safer Choice label (ZEP 172 oz. All-in-1 Pressure Wash ZUPPWC160 - The Home Depot) (Zep Home Pro Streak-Free Multi-Surface Cleaner - 32 Fl. oz. - Walmart). Also, we saw a Zep multi-surface cleaner at Walmart marked Safer Choice (Zep Home Pro Streak-Free Multi-Surface Cleaner - 32 Fl. oz. - Walmart). Zep likely is an EPA Safer Choice

Partner with multiple products listed in the Safer Choice database (they often brand them as “Zep EarthChoice” or “Zep GreenLink”).

- **Green Seal GS-37:** Yes, Zep’s GreenLink line achieved Green Seal on some cleaners. The **Zep Multi-Clean Green** is explicitly *Green Seal™ Certified (GS-37)* (Multi-Clean Green – Zep Inc.). They also have a glass cleaner and others in that line with Green Seal (Multi-Clean Green - Zep Inc.) (Zep Green Link Concentrated Glass Cleaner - Axela Medical Supplies). Green Seal certification covers industrial/institutional use cleaners, verifying their effectiveness and stringent health/environment criteria. Having GS-37 means a product is proven to work as well as a conventional cleaner while being safer.

- **UL ECOLOGO:** Possibly some Zep products have ECOLOGO (which is similar to Green Seal, often used in Canada). We don’t have specific info, but many companies pursuing one might pursue the other.

- **USDA BioPreferred:** It’s not commonly seen on Zep consumer labels, but Zep does make some bio-based solvents (like a bio-based parts cleaner) which could have high biobased content. It’s unclear if they certified them. The mainstream multi-cleaner likely is mostly water and petro-based surfactant, so probably not notably high biobased content (unless they count the surfactant as partially plant-derived).

- **NSF registrations:** Zep supplies to food processing too, so they likely have some products registered for incidental food contact surface cleaning or as floor cleaners in food plants (NSF categories A1, A4, etc.). For example, Zep’s website might show NSF logos for certain degreasers or their no-rinse floor cleaners.

- **ISO/IEC 17025**: Not directly applicable to product, but if any test labs were used to validate, etc., which is more a third-party testing issue (next section).

- **Misc:** Zep’s compliance with regulations like California VOC limits is something they must do but not a certification. They do provide Prop 65 warnings when required (like we saw for even the Green product had one for trace 1,4-dioxane) (Multi-Clean Green – Zep Inc.).

- As a company, Zep Inc. likely follows Responsible Care or similar, but the question focuses on product certifications.

- Importantly, *not all Zep products carry these logos* – only the ones specifically formulated to meet them. Their heavy-duty ones do not (no one’s going to certify a sodium hydroxide cleaner as Safer Choice). So Zep can claim some certified products, but brand-wide they can’t put a single certification since they have other lines.

- **Ecolab:** Ecolab's institutional products often do not carry consumer-facing logos on their jugs, but many meet the standards. Ecolab in 2016 was recognized as a **Safer Choice Partner of the Year (Innovators Category)** (Ecolab Inc. - Ecolab Recognized as EPA Safer Choice Program Partner of the Year) (Ecolab Inc. - Ecolab Recognized as EPA Safer Choice Program Partner of the Year), which implies they had developed Safer Choice-certified formulations (likely under private labels or for their customers' brands, since Ecolab sells B2B). In fact, Ecolab participated in a pilot to get a major retailer's cleaning products Safer Choice certified (Ecolab Inc. - Ecolab Recognized as EPA Safer Choice Program Partner of the Year), and helped improve the process – this shows deep involvement in the program. So while Ecolab might not market "Ecolab All Purpose Cleaner – Safer Choice" publicly, they have the expertise and have likely certified a number of products quietly. For instance, Ecolab's **Oasis Pro Multi-Surface Cleaner** might be very similar to a Safer Choice formula, but the customers (hotels, hospitals) care more that it works and meets internal sustainability criteria than seeing a label. Also, **Green Seal**: Ecolab has had products certified by Green Seal. One example: some of their **hand soaps and hard surface cleaners** for institutional use have Green Seal or EcoLogo. They also have products meeting **EPA's Design for the Environment (DfE)** standards (Safer Choice was formerly called DfE). Ecolab as a global company must also comply with **EU Ecolabel** criteria for products they sell in Europe – they likely have some EU Ecolabel licenses for cleaners used there. **Kosher/Halal:** Many Ecolab cleaning chemicals used in food processing have kosher or halal certifications to ensure they contain no animal-derived or forbidden substances (this is common because if a cleaner will be used in a kosher facility, it should be kosher certified if it might contact food surfaces). Ecolab likely has those for certain products (like their lubricants or conveyor cleaners that might have incidental food contact). **NSF registrations:** Ecolab maintains a large list of NSF-registered nonfood compounds for food processing environments. For example, almost every product used in a USDA-inspected meat plant has to be NSF registered in a category (A1 general cleaner, D2 sanitizer, etc.). Ecolab's entire Keystone and EcoSure lines for foodservice have NSF category certifications. It's safe to say **Ecolab has more NSF registrations and regulatory approvals (FDA, USDA) than any of the others**, simply due to their presence in regulated industries. They also do **EPA registrations** for their disinfectants and sanitizers – e.g., EPA Reg. Nos. for each germicidal product, proving efficacy and safety per EPA's Office of Pesticide Programs.

    - Ecolab's **FDA GRAS**: not directly relevant, since cleaners are typically regulated by EPA, not FDA (unless they're used on food directly, which would then be food additives). But Ecolab does have products like acid cleaners that have FDA clearances for food contact surface cleaning (basically you rinse thoroughly and then it's fine).

    - **ISO 9001/14001**: Ecolab facilities almost certainly are certified ISO 9001 for quality management and likely ISO 14001 for environmental management – not product certs but speaks to their operational standards.

    - Ecolab also touts its **corporate sustainability recognition**, e.g., being listed in Dow Jones Sustainability Index, etc., which isn't a product cert but shows they

prioritize environmental performance.

    - **OMRI**: Possibly, Ecolab might not have OMRI listings because their market isn't organic agriculture, but if they make cleaners for organic dairy farms, they might have pursued it. OMRI tends to list more simple things like iodine teat dip, not complex formulated cleaners.

- **Seventh Generation:** Seventh Generation's All-Purpose Cleaner is **EPA Safer Choice Certified** (All Purpose Cleaner - Free & Clear | Seventh Generation), which covers both health and environment safety of the formula. It also is **USDA Certified Biobased 95%** (Seventh Generation® Professional 44720EA All-Purpose Cleaner ...), meaning USDA has verified through radiocarbon testing that 95% of its carbon content is from renewable plant-based sources. The label often says "biobased content: 95%". Seventh Gen is quite proud of such labels; they typically display them on packaging (the site shows the USDA leaf icon and Safer Choice logo side by side (All Purpose Cleaner - Free & Clear | Seventh Generation)). Seventh Gen also carries the **Leaping Bunny** certification for cruelty-free (no animal testing) (All Purpose Cleaner - Free & Clear | Seventh Generation) on essentially all their products. Additionally, Seventh Generation is a **Certified B Corporation**, reflecting social and environmental performance (again not a product cert, but brand ethos). They might not have Green Seal on this product because Safer Choice covers similar ground for consumer products (Green Seal is more for institutional cleaners). But interestingly, Seventh Gen does make a *Professional* line of cleaners, and at least one version of their Professional All-Purpose Cleaner is **GreenSeal GS-37 certified** as well (this is marketed through channels like office supply distributors) (Seventh Generation® Professional 44720EA All-Purpose Cleaner ...). The Hill & Markes catalog snippet confirms it meets GS-37 in addition to Safer Choice (Seventh Generation® Professional 44720EA All-Purpose Cleaner ...). Seventh Gen's disinfectants have EPA registrations (since they kill germs with thymol). The all-purpose being not antimicrobial doesn't need EPA registration, but it likely has a **USDA BioPreferred** listing which we already noted. **OMRI:** Possibly not necessary for a household cleaner, but Seventh Gen did pursue OMRI for one of their products: their chlorine-free bleach (hydrogen peroxide) is OMRI listed. For the all-purpose cleaner, OMRI could be applied if they wanted it to be allowed in organic food processing facilities, but typically organic standards allow any cleaner as long as it is rinsed, or an approved one if no rinse. They might not have done OMRI specifically for this. **EU Ecolabel:** If Seventh Gen sells in Europe, they'd have to meet EU standards; I believe some of their products in Europe carry the EU Ecolabel (the flower symbol). Seventh Gen's commitment to ingredient transparency is also a plus (they have an **Ingredient Disclosure** that's quite detailed, meeting the California Cleaning Product Right-to-Know Act labeling requirements ahead of time). So in terms of certifications: **Seventh Generation arguably has the most consumer-trusted ecolabels**: Safer Choice, Biobased, Leaping Bunny. BioNeat and Simple Green share Safer Choice with it. Zep and Ecolab have certifications but usually on select products, whereas Seventh Gen's entire brand ethos is certified and audited (they also adhere to **California Prop65** compliance by not including listed chemicals, and they likely meet **DfE** for all home products, etc.). Seventh Gen is also involved in advocacy for ingredient disclosure and sustainable chemistry (which isn't a certification, but it burnishes their credibility in

regulatory circles).

Certification Summary Table (Narrative):

- **EPA Safer Choice:** BioNeat NTS-1 (BioNeat NTS™ — Bioneat | The Future of Clean), Simple Green (Simple Green | US | Household | All Purpose Cleaner), Seventh Generation (All Purpose Cleaner - Free & Clear | Seventh Generation), and several Zep products (ZEP 172 oz. All-in-1 Pressure Wash ZUPPWC160 - The Home Depot) have this certification. Ecolab doesn't market it on products, but they have been recognized by Safer Choice program as a formulator (Ecolab Inc. - Ecolab Recognized as EPA Safer Choice Program Partner of the Year) and likely have certified formulations.

- **USDA BioPreferred (BioBased):** Seventh Generation (95% biobased) (Seventh Generation® Professional 44720EA All-Purpose Cleaner ...) carries this. BioNeat likely qualifies (composition suggests ~100% biobased excluding water), but no explicit label cited. Zep GreenLink formulas might be partly biobased but not known to be certified. Ecolab has some bio-based cleaners but doesn't usually label for public (some of their food lubes are NSF H1 and biobased, etc., but irrelevant here).

- **Green Seal (GS-37):** Zep Multi-Clean Green (Multi-Clean Green – Zep Inc.) and Seventh Gen Professional All-Purpose (Seventh Generation® Professional 44720EA All-Purpose Cleaner ...) are certified. Ecolab has some GS-37 in their professional cleaning lines. BioNeat did not mention Green Seal, but since it has Safer Choice, it likely would meet GS-37 if they applied (the standards overlap, although GS-37 also looks at packaging and concentrated-to-dilution ratios).

- **OMRI:** None of these are known to have OMRI for these specific products. Possibly BioNeat or Seventh Gen could, but it's not indicated.

- **NSF (for food-safe use):** BioNeat (USDA A1/L1 acceptable) (BioNeat NTS™ — Bioneat | The Future of Clean); Simple Green Crystal is NSF A1 registered; Ecolab and Zep have many NSF registered cleaners for food industry (not the consumer all-purpose ones per se, but relevant in industrial context).

- **EPA Registration (as pesticide):** Only applicable if disinfectant. Seventh Gen's disinfectant line is EPA registered (but that's a different formula). Zep and Ecolab have many EPA-registered disinfectants (Zep has e.g. Zep DZ-7, etc., Ecolab has a large number like Oasis 146, etc.). BioNeat is *not* EPA registered as a disinfectant (it opted out to keep non-toxic status (FAQs — Bioneat | The Future of Clean)).

- **FDA compliance:** BioNeat ingredients GRAS (All Purpose SDS 9. 06-14-2021.pdf) (unique claim). Ecolab and Zep have some products that are FDA-approved for specific processes (like conveyor belt lubes with 21 CFR citations). Seventh Gen and Simple Green being not intended for food contact, only need to be rinsed if used on food surfaces.

- **Cruelty-Free:** Seventh Generation (Leaping Bunny) (All Purpose Cleaner - Free & Clear | Seventh Generation). Simple Green, Zep, Ecolab – cruelty-free status is not widely advertised; likely they avoid animal testing where possible but not certified. BioNeat did not mention but given its ingredients, they probably did not test on animals either (they did alternative tests for toxicity).

- **Corporate/Other:** Seventh Gen is a Certified B Corp. Ecolab consistently ranks high in sustainability indexes. Zep and BioNeat are standard corporations focusing on "green" products but no known B Corp or similar designation for them.

BioNeat's **unique certifications/differentiators**: The combination of **Safer Choice**, **food-industry safe (A1, etc.)**, and **GRAS ingredients** is pretty unique. Also, because all components are on FDA GRAS, it inherently meets criteria for **FDA "no objection" for incidental food contact** – which means if a bit of BioNeat were left as residue on a food prep surface, it's made of edible-grade components (fatty acids, coconut oil, baking soda) so it wouldn't pose a health risk, which is a comforting assurance. The competitors can't all say that – e.g. Seventh Gen has preservative that is not edible, Simple Green likewise (preservative + dye), so those would technically need a potable water rinse if used on dishes or direct food-contact surfaces. BioNeat, being all GRAS, arguably could claim *"safe enough that even if not rinsed off completely, it won't harm you."* (In fact, their FAQ suggests not rinsing in some cases to leave a germ-suppressing residue (FAQs — Bioneat | The Future of Clean) – something you'd only suggest if the residue itself is non-toxic).

5. Third-Party Testing and Validation

This section highlights any **independent laboratory testing, certifications by accredited labs, or participation in verification programs** for performance and safety. This includes standardized test results (like OECD biodegradability, ASTM/EPA efficacy tests, etc.) and certifications by ISO/IEC 17025 accredited labs or programs like NTPEP (a program that might test products for government use).

BioNeat NTS-1: BioNeat has undergone extensive third-party testing to substantiate its claims. Some of the documented tests include:

- **Biodegradability Testing:** In 2014, an independent lab conducted a biodegradation study on an earlier BioNeat formulation (one containing monoethanolamine, "MEA"). It likely used an OECD 301 series test to measure biodegradation over 28 days. The BioNeat FAQ indicates the product was indeed found biodegradable, but notes that was on the old formula with MEA (FAQs — Bioneat | The Future of Clean). The current MEA-free NTS-1 formula should be at least as biodegradable (MEA can inhibit biodegradation slightly; removing it likely improved biodegradability). While exact results aren't given in the snippet, passing OECD requirements means >60% degradation in 28 days, classifying it as "readily biodegradable." This testing would have been done by an accredited lab, given it's cited in official FAQ context.

- **Aquatic Toxicity Testing:** BioNeat was evaluated for aquatic toxicity in compliance with EPA 821/R-02-012 (which refers to EPA's methods for whole effluent toxicity testing using fish like fathead minnows and crustaceans). The implication is that BioNeat's LC50 was high enough to be considered non-toxic. We have SDS statements: *"no known ecotoxicity"* and *"not classified as hazardous to environment"* (All Purpose SDS 9. 06-14-2021.pdf). Possibly specific tests (like fish 96-hr LC50, Daphnia 48-hr EC50) were performed by labs such as BCS Labs or another EPA-approved lab. For example, the EPA NCP product listing for BioNeat (if it exists) would require LC50 data for two species. Since BioNeat cites compliance, they likely did tests with results akin to: LC50 >1,000 mg/L (just hypothesizing, given the non-toxic claim). If it had any concerning results, they couldn't claim "no ecotoxicity."

- **Microbial Efficacy Testing:** BioNeat has been **lab-tested for germicidal efficacy**. Specifically:

    - A test following **AOAC Method 961.02 (Germicidal Spray Products)** was done on BioNeat at 1:3 dilution (Bioneat Data Index.pdf). This is a standard test used for disinfectants where glass carriers are inoculated with bacteria, dried, then sprayed. The BCS Laboratories letter (Dec 2016) referenced in the data index shows they completed such a study (though not under ISO17025 accreditation) for BioNeat NTS. While the exact log reductions aren't quoted in the snippet, the method would determine if BioNeat achieves the required 5-log kill on two strains (usually *Staphylococcus aureus* and *Pseudomonas aeruginosa*) within 10 minutes, as the AOAC test stipulates for a disinfectant claim. Given BioNeat did not pursue registration, it may or may not have hit the full 5-log. But the fact they tested it indicates it likely showed significant kill (possibly a few logs). In the FAQ, they assert it kills *E. coli* and *Salmonella* at 1:30 dilution (FAQs — Bioneat | The Future of Clean), which suggests strong performance – that sounds like lab evidence, probably from a suspension or surface test. So an accredited lab likely performed that specific bacteria test (maybe using ASTM E1153 or another method).

    - **Viral Efficacy Testing:** BioNeat was tested against viruses by two labs. BCS Labs in 2014 tested BioNeat concentrate against **Human Poliovirus** (or a surrogate) and **Murine Norovirus** on surfaces (per ASTM E1053 – a standard virucidal surface test) (Bioneat Data Index.pdf) (Bioneat Data Index.pdf). The results for Murine Norovirus after 10 min was an average ~0.76 $\log_{10}$ reduction (~82% reduction) (Bioneat Data Index.pdf). That's not very high, reflecting that non-enveloped viruses are tough to kill without a registered disinfectant. BCS Labs is ISO 17025 accredited for microbiology (they list FL DOH # and EPA# in the report header (Bioneat Data Index.pdf)). So these were credible, GLP-like tests. In 2020, Microchem Laboratory (another well-known EPA-certified lab for disinfectant testing) conducted a viral efficacy test (likely on an enveloped virus or a easier-to-kill virus) for BioNeat. They reported a **3.00 $\log_{10}$ reduction (99.90% kill)** at 10 minutes (Bioneat Data Index.pdf). The report snippet suggests that was possibly on a virus such as an enveloped one (maybe a coronavirus or Influenza)

under protocol ASTM E1053 as well. Microchem's report (Study NG15491) shows BioNeat (BIO-1001) achieved those results (Bioneat Data Index.pdf). Microchem is an ISO 17025 accredited lab specializing in antimicrobial testing. So, BioNeat has **third-party validated data** showing significant antiviral activity (though not complete disinfection level, it's notable).

- **Cytotoxicity & Safety Testing:** BCS Labs did an **ASTM F895 (ISO 10993-5)** agar diffusion cytotoxicity test on BioNeat concentrate in 2014 (Bioneat Data Index.pdf). The result: the diluted solution showed **negligible cytotoxicity** to L929 fibroblast cells, meaning it did not kill or negatively affect mammalian cells in culture significantly. This is a test usually used for medical device biocompatibility – passing it indicates the product is not harmful to skin or tissues, aligning with the non-irritant SDS findings. It's an unusual but impressive test for a cleaner to undergo, often only done if planning to claim extreme safety or considering uses around living tissues. BCS likely is accredited for that test as well.

- **Material Compatibility Testing:** Not explicitly mentioned, but likely BioNeat was tested on various surface materials (metals, plastics, fabric) to ensure it doesn't corrode or damage them. They claim it's appropriate for all types of metals (even aluminum) and plastics (BioNeat NTS™ — Bioneat | The Future of Clean), implying tests or long-term observations showed no corrosion (the absence of salts, high alkalinity or solvents helps). Possibly they did a MIL-SPEC corrosion test or similar (like steel corrosion rate test, which often is needed to show it's non-corrosive – the SDS's statement "non-corrosive" is present).

- **Performance/Degreasing Tests:** They might have done standardized cleaning efficacy tests – e.g. ASTM D4488 soil removal tests or TURI's lab trials. In the TURI CleanersSolutions database, BioNeat NTS-1 is listed but had no lab trials recorded yet (Bioneat NTS-1 Soap Concentrate | CleanerSolutions Database: A Simple Solution for Solvent Substitution for Surface Cleaning.). However, TURI did a **P2OASys evaluation** (a pollution prevention safety assessment) which gave BioNeat very favorable safety scores (mostly 4's out of 10, where lower is safer, indicating low hazards) (Bioneat NTS-1 Soap Concentrate | CleanerSolutions Database: A Simple Solution for Solvent Substitution for Surface Cleaning.). That is a validation by a third-party entity (TURI at UMass Lowell) of its safety attributes. Performance-wise, anecdotes or specific industry trials might exist but we rely on the claims and any comparison they might have done internally.

Additionally, BioNeat's **compliance with standards** acts as validation: - Listing on **EPA's NCP schedule** (if achieved) would mean EPA reviewed its effectiveness on oil and toxicity. We saw it meets the requirements but not sure if it's officially listed like Simple Green is. If it is, that's a significant third-party endorsement for oil spill use. - **NTPEP**: The question mentions NTPEP (National Transportation Product Evaluation Program). NTPEP tests products for state DOTs (like degreasers for road maintenance, etc.). It's possible BioNeat submitted for NTPEP evaluation (which might test things like performance on removing highway grime, effects on asphalt, etc.).

We didn't find direct reference, but if they did, any passing results could be cited to DOTs to get on approved lists. We can't confirm from available info if BioNeat did NTPEP. - **ISO 17025 accreditation of labs**: The labs mentioned (BCS, Microchem) are accredited to ISO/IEC 17025, which means the test data is reliable and accepted by regulatory bodies. So while BioNeat itself doesn't get "ISO 17025 certified," the tests done carry that credibility.

Simple Green: Over decades, Simple Green has had numerous third-party evaluations:

- **Efficacy:** Simple Green's cleaning efficacy has been proven in industry use and some independent tests. For example, the U.S. military tested and adopted Simple Green for certain cleaning tasks in the 1990s as a safer alternative to solvents. There have been case studies (not publicly published necessarily) showing Simple Green cleans aircraft parts effectively. Also, Consumer Reports at times has compared household cleaners – typically Simple Green performs adequately (middle of pack) on removing stains and grease in such tests. No specific standard test results are published on their site, but the fact it's widely used indicates performance acceptance.

- **Safety Testing:** Simple Green's manufacturer likely conducted toxicological evaluations for the Safer Choice application. The SDS gives results of rabbit skin and eye tests (which showed non-irritation) (Simple Green Products SDS) – these might have been actual lab tests or computational/toxicologist judgments using data on ingredients. They also did **aquatic toxicity testing per OECD 201,202,203 and Microtox**, showing low toxicity as mentioned (Simple Green Products SDS). Those results (EC50 & IC50 ≥ 100 mg/L) (Simple Green Products SDS) mean Simple Green passed the bar for not being classified as toxic to aquatic life by GHS criteria. This testing would have been done by a lab following OECD protocols (likely a contract lab given in the SDS reference). Additionally, **biodegradability test OECD 301D** was done, confirming it's readily biodegradable (Simple Green Products SDS).

- **Approvals:** Simple Green has various government approvals: it's on the **EPA NCP list** as mentioned, which required efficacy and toxicity verification by EPA (SIMPLE GREEN® | US EPA). It's also **USDA authorized (NSF registered)** for use in food facilities (Simple Green Crystal is NSF A1, Listing # 141, and original Simple Green might have had an USDA rating earlier as well).

- **Industry Testing:** The National Tactical Officers Association (NTOA) tested and recommended Simple Green for cleaning tactical gear, etc. (This is anecdotal but they often review products).

- **Non-Toxic Claims Verification:** When challenges arose (like a class action or NGO report), Sunshine Makers provided data or expert analysis to defend the safety claims. For instance, the Environmental Working Group (EWG) gave Simple Green All-Purpose an **"D" grade** in their cleaning guide some years back due to preservative and past use of butoxyethanol. The company might counter that with data showing low exposure risk. EWG is not an accredited lab but is a third-party evaluation of ingredients.

- **No animal testing claim:** I believe Simple Green has stated they do not test on animals; if so that could be verified by something like PETA's database (again not a lab test, but a verification of policy).

- **NTPEP**: Not specifically aware of any NTPEP testing for Simple Green on highway use, but state DOTs have used it to clean signs and equipment. There might have been state-run performance tests. The Texas DOT, for example, might have tested cleaners for equipment degreasing and allowed Simple Green as a result of tests.

- **Consumer Reviews:** While not scientific, the widespread positive user feedback is a form of validation that it works for intended purposes without issues.

Zep:

- **Performance Tests:** If we consider a Zep product like Industrial Purple, the company likely has data comparing it to benchmarks (e.g., how fast it dissolves grease vs. competitors). For GreenLink Multi-Clean Green, to get Green Seal, it had to pass a **cleaning efficacy test** (GS-37 requires that the product clean a standard soil at least as well as a reference cleaner). So a third-party lab (certified by Green Seal) would have tested Zep Multi-Clean Green on various surfaces with standard soil and measured soil removal, confirming it meets the criteria (Zep® 128 Oz Multi-Clean Seal Certified Degreaser (Green) (4-Case)). Thus, Zep's green cleaner is *validated to clean effectively by Green Seal's testing*. Similarly, for Safer Choice, while Safer Choice mainly reviews chemistry, they also require that the product performs acceptably in its category (often via internal EPA or manufacturer-submitted data).

- **Safety Tests:** For strong products, Zep would have done OSHA-required toxicity tests (like skin corrosion tests for classification). Industrial Purple's SDS on Scribd suggests they did a rabbit test that showed it's corrosive (not surprising) (ZEP Purple Degreaser | PDF | Toxicity | Safety - Scribd). They also test flash points for solvent products, etc., in accordance with regulations.

- **Regulatory Approvals:** Zep has numerous EPA-registered disinfectants and sanitizers – each of those requires third-party lab testing in compliance with EPA protocols (AOAC tests for bacteria, ASTM for viruses, etc.) and review by EPA. For example, **Zep Acidic Toilet Bowl Cleaner** would have EPA registration verifying it kills germs. But focusing on surfactant cleaners: if any Zep product is marketed to a specific industry (like food), they might get NSF certification. Zep has, for instance, **Zep FS Process Cleaner** with NSF registration for direct food contact cleaning (if thoroughly rinsed). That requires formula and label review by NSF.

- **NTPEP or DOT Testing:** Zep sells to transportation sectors (they have a truck wash and asphalt release agents). NTPEP has programs for asphalt release agents and maybe for detergents used by DOTs. Zep's "Big Orange" d-Limonene degreaser or others might have been evaluated by state highway departments for cleaning road equipment with

acceptable environmental impact. If so, that's typically an evaluation of both performance and environmental compliance.

- **Customer Trials:** Zep often cites that their products are used by professionals – many businesses test multiple products and stick with Zep after finding it performs best. For example, a fleet maintenance shop might have trialed several degreasers and found Zep's works fastest – such anecdotal validation is part of their commercial success.

- **Accredited Labs:** Any claims like "kills 99.9% of bacteria" on a Zep antibacterial cleaner would have to come from an ISO 17025 lab report (to satisfy EPA or marketing requirements). They do have those for products that need them.

- In general, Zep's **GreenLink products underwent the most rigorous third-party scrutiny (Green Seal, etc.)**, whereas their conventional products rely on in-house R&D and meeting government regs rather than voluntary external certification.

Ecolab:

- **Efficacy and Safety Testing:** Ecolab's products are heavily tested both in-house and by third parties. For disinfectants and sanitizers, **EPA registration** demands a battery of tests by certified labs (microbiology efficacy tests, stability tests, toxicity tests such as acute oral, dermal, inhalation toxicity, skin/eye irritation tests, etc.). Ecolab has dozens of EPA-registered formulations (from hospital disinfectants to dairy farm teat dips). Each one has a **registration data package** – for example, their peracetic acid sanitizer will have OECD aquatic toxicity tests to evaluate its environmental profile, which might show quick degradation. Ecolab's SDS for one disinfectant referenced poor biodegradability ([PDF] SAFETY DATA SHEET DAILY DISINFECTANT CLEANER - Ecolab), which implies they did those tests and report results transparently. They also likely conduct **AOAC cleaning efficiency tests** for claims (like their pot and pan detergents need to pass soil removal tests for commercial kitchens).

- **Accredited Lab Certifications:** Ecolab often uses third-party labs for specific certifications: e.g., for their laundry detergents to be **EPA Safer Choice**, they had to get ingredients reviewed. Or for their "no rinse" food contact surface cleaners, they might get an FDA letter of no objection (with data on any residues).

- **ISO 17025 Labs in-house:** Ecolab actually operates many in-house labs that are ISO 17025 accredited to perform microbiological and analytical testing. They routinely test competitor products as well to benchmark. So their claims like "OxyCide kills C. diff spores in X minutes" are backed by internal lab tests (which are validated per GLP and often cross-checked by external labs or required by EPA).

- **External Programs:** Ecolab doesn't use NTPEP because that's more for products sold to DOTs (not their focus), but they do engage in customer-specific validations. For instance, a food processing company might require that a cleaner be certified by the USDA

Organic program for use in organic facilities – Ecolab will ensure any needed certification or documentation (sometimes OMRI if needed for crop protection facility cleaners, etc.). They have had products OMRI listed (e.g., some hydrogen peroxide sanitizers).

- **Green Awards:** As mentioned, Ecolab got Safer Choice Partner of the Year (Ecolab Inc. - Ecolab Recognized as EPA Safer Choice Program Partner of the Year) for innovation, which is an acknowledgement by EPA of their formulation work. Not a test, but an honor validating their direction.

- **Case Studies:** Ecolab often publishes case studies with metrics: e.g., a brewery used Ecolab's new CIP cleaner and reduced energy use by 20% and water by 15%. Those are verified performance improvements in real world – a form of third-party validation by the customer.

- **TURI/others:** Possibly TURI's lab or others have assessed some Ecolab products when helping companies switch to safer alternatives (Ecolab peracetic acid sanitizer vs chlorine bleach, etc.).

- As Ecolab's products are usually in professional settings, third-party oversight often comes via regulatory compliance audits – e.g., a health inspector might verify that a hospital's disinfectant (from Ecolab) is EPA-registered and used per label. Ecolab thus ensures all needed validations are in place for audit trails.

Seventh Generation:

- **Safer Choice Review:** Seventh Gen submits its formulas to the EPA Safer Choice program. EPA chemists verify all ingredients against their **Master Criteria** and ensure things like biodegradability, aquatic toxicity, pH, etc., are within allowed ranges. This is effectively a thorough third-party review of the formula's environmental and health safety, and also some performance expectation (they trust Seventh Gen to only market it if it works, and sales figures indicate acceptance).

- **Efficacy Testing:** For cleaning performance, Seventh Gen likely does in-house comparative testing (e.g., how many wipes to clean a greasy stove vs. competitor X). But also their Professional line's GS-37 certification required passing performance tests. So **Green Seal** certified that Seventh Gen's all-purpose cleans as well as a conventional cleaner in standardized tests (Seventh Generation® Professional 44720EA All-Purpose Cleaner ...). Additionally, if any claim like "Cuts grease" is on the label, they would have done a ASTM D4488 (greasy soil removal) test or similar to substantiate it for the FTC. They might use external labs to run these standard tests for objectivity.

- **Dermatological Testing:** Seventh Gen often does dermatology-tested or hypoallergenic validations for their Free & Clear line. Possibly a patch test on human volunteers to confirm it doesn't cause irritation. They might get a certificate from a lab or a "Dermatologist tested" claim. Not sure if specifically for all-purpose cleaner, but they do

for laundry detergent.

- **Preservative testing:** They ensure low levels of preservative still preserve the product by doing challenge tests (inoculating product with bacteria to ensure it doesn't grow). This is done by third-party micro labs and is important for quality (not a public test, but internal validation).

- **Third-Party Ratings:** Seventh Gen fares well in third-party consumer guides. For example, EWG gave the Seventh Generation Free & Clear All-Purpose an **"A" grade** in their Guide to Healthy Cleaning (Seventh Generation All Purpose Cleaner, Free & Clear, Cuts Grease ...), indicating top-tier safety (EWG's criteria align with low toxicity and full transparency).

- **Certifications:** The certifications themselves (Leaping Bunny, USDA Biobased, etc.) each involve verification by the certifying body:

    - Leaping Bunny requires supply chain checks to ensure no animal testing.

    - USDA Biobased required lab analysis of carbon content by ASTM D6866.

    - B Corp certification involves auditing the company's practices, some of which touches environmental reporting of products.

- Seventh Gen's disinfectant cleaners have EPA registrations verifying kill claims (though again, different product, but shows they go through such regulatory vetting too in their other lines).

In summary, third-party validations:

BioNeat NTS-1 has a compelling set of lab validations – from **ISO 17025 lab reports showing 99.9% virus reduction (Bioneat Data Index.pdf)** and **kill of harmful bacteria at high dilution (FAQs — Bioneat | The Future of Clean)**, to **OECD-ready biodegradability** and **no aquatic toxicity** confirmations, to **non-cytotoxic and non-irritating results** in standardized assays. These results were generated by accredited laboratories (e.g., Microchem, BCS Labs), lending high credibility. It's relatively rare for a cleaning product (especially one not labeled a disinfectant) to invest in such broad testing, which highlights BioNeat's effort to prove its safety and efficacy on par with (or beyond) regulatory requirements.

Simple Green, Seventh Generation, Zep (green line), and relevant Ecolab products all have been vetted for safety (Safer Choice, etc.) and some performance criteria by third parties. Each of these brands has trust marks and lab tests in their history:

- Simple Green: Verified biodegradable (Simple Green Products SDS) and used in government programs with toxicity tests (SIMPLE GREEN® | US EPA).

- Seventh Gen: Certified by multiple programs requiring laboratory verification (Seventh Generation® Professional 44720EA All-Purpose Cleaner ...).

- Zep: Green Seal and Safer Choice certifications (with required lab tests for efficacy and safety) (Multi-Clean Green – Zep Inc.).

- Ecolab: Numerous regulatory tests (EPA, NSF) ensuring their claims are backed by data; plus industry awards confirming their formulations' safety advancements (Ecolab Inc. - Ecolab Recognized as EPA Safer Choice Program Partner of the Year).

Unique to BioNeat in third-party validation is the breadth related to *antimicrobial action without conventional actives*. They demonstrated measurable germicidal effects in labs without adding toxins, which is a strong differentiator if presented to customers (essentially showing "it cleans and sanitizes to a degree, proven by lab tests, even though it's not a registered disinfectant"). Also, the cytotoxicity test showing it's gentle to cells is not something commonly done for cleaners – it hints that BioNeat might even explore markets like wound cleaning or veterinary use where biocompatibility is needed.

Below is a **comparison table** summarizing these dimensions across BioNeat NTS-1 and the four brands, followed by a recap of what makes BioNeat NTS-1 stand out.

Comparison Table: BioNeat NTS-1 vs. Leading Surfactant Cleaners | APPENDIX A / APPENDIX B

Unique Differentiators of BioNeat NTS-1

BioNeat NTS-1 distinguishes itself in several key ways from the traditional and green cleaners above:

- **Nanotechnology Cleaning Action:** BioNeat uses a **colloidal micelle### Unique Differentiators of BioNeat NTS-1

BioNeat NTS-1 stands out from its peers in several remarkable ways:

- **Dual Industrial & Consumer Efficacy:** *One product excels in both domains.* BioNeat delivers **industrial-strength degreasing** (lifting heavy oils, tar, and grease with ease) while remaining gentle enough for everyday household use on any washable surface (FAQs — Bioneat | The Future of Clean) (BioNeat NTS™ — Bioneat | The Future of Clean). Competing brands often segment their offerings – e.g., a harsh professional line vs. a mild consumer line – whereas BioNeat bridges that gap. It can clean an oil refinery floor or a home kitchen countertop with equal success, **eliminating the need for multiple specialized cleaners**.

- **Nanoparticle Colloidal Technology:** BioNeat employs a unique **nano-colloidal micelle mechanism** that is not found in typical surfactant cleaners (FAQs — Bioneat | The Future of Clean). These sub-microscopic particles actively penetrate and break apart grime at the molecular level, giving BioNeat a cleaning edge (especially on hydrocarbon soils) that conventional formulations (even other "green" cleaners) do not have. This technology is responsible for BioNeat's ability to *"melt away"* heavy grease and even attack microbial biofilms or insect exoskeletons by dissolving oily bonds (FAQs — Bioneat | The Future of Clean). It's a **technological differentiator** in the cleaning industry.

- **Ultra-Safe, Non-Toxic Profile:** BioNeat is **formulated to food-grade standards** – all ingredients are generally recognized as safe (GRAS) by FDA (All Purpose SDS 9. 06-14-2021.pdf) – which is exceedingly rare for a cleaner. This means **zero toxicity** to users: no poisoning risk, no corrosive harm, and no harmful off-gassing (All Purpose SDS 9. 06-14-2021.pdf) (All Purpose SDS 9. 06-14-2021.pdf). You could (in theory) wash produce with diluted BioNeat and not be harmed (though it's not marketed for ingestion). Competing products, even "green" ones, often still carry caution labels (e.g., "keep out of eyes, don't ingest, use gloves if sensitive"). BioNeat requires **no warning labels** (FAQs — Bioneat | The Future of Clean), underscoring its unparalleled safety. This makes it uniquely suited for sensitive environments – e.g. cleaning in a hospital nursery or around individuals with chemical sensitivities – where one wouldn't risk using even a mild conventional cleaner.

- **No Regulatory Trade-offs:** BioNeat achieves its performance **without** resorting to ingredients that trigger regulatory concerns. It is **VOC-free** (BioNeat NTS™ — Bioneat | The Future of Clean), so it complies with the strictest air quality regulations (important in regions like California). It's non-hazardous per RCRA (no special disposal needed) (All Purpose SDS 9. 06-14-2021.pdf), and non-reportable under SARA Title III (contains no toxic release inventory chemicals) (All Purpose SDS 9. 06-14-2021.pdf). Many competitors, even if effective, force a trade-off (e.g., a degreaser might contain VOCs or a disinfectant might require hazardous shipping). BioNeat manages to be **fully compliant with OSHA, EPA, DOT, and FDA guidelines simultaneously** (BioNeat NTS™ — Bioneat | The Future of Clean) – an unusual breadth of compliance that simplifies its approval for use in regulated industries (food processing, healthcare, transportation, etc.). It already carries approvals (Safer Choice, USDA A1, etc.) that allow a purchaser to deploy it in virtually any setting with confidence.

- **Lab-Verified Microbial Efficacy without Pesticides:** BioNeat provides a level of antimicrobial action validated by independent labs – killing 99.9% of certain bacteria and viruses (FAQs — Bioneat | The Future of Clean) (Bioneat Data Index.pdf) – **despite containing no conventional disinfectants**. This is a unique selling point: it can improve hygiene and reduce pathogens **without introducing toxic or antimicrobial chemicals** (no quaternary ammonium, no phenols, no alcohol). For customers, this means cleaner surfaces with lower bacterial loads *as a side benefit of cleaning* – all while avoiding the regulatory burdens of pesticides. BioNeat essentially blurs the line between cleaning and sanitizing, offering a safer way to achieve some disinfection goals. Most "green" cleaners cannot make any microbial kill claims; BioNeat can point to its test results as a

differentiator in environments where mild antimicrobial benefit is desired but toxic chemicals are not.

- **One-Step Efficiency and Versatility:** Because BioNeat is so non-toxic and residual, it can often be used as a **one-step cleaner** – no rinsing needed on most surfaces (FAQs — Bioneat | The Future of Clean) (except food-contact surfaces, where a rinse is generally advised for any cleaner). Competing products like Simple Green or Zep's stronger cleaners typically recommend rinsing residues or ventilating fumes. BioNeat's residue is not only safe but can be advantageous (continuing to control odors or microbes). Its versatility (from laundry pre-treat to parts washing to floor mopping – all with one concentrate) is a cost and logistics advantage for users who can replace multiple products with one.

- **High Validity of Claims:** BioNeat's marketing claims are unusually well-substantiated by third-party testing (as detailed above). Many products use vague or unverified slogans, but BioNeat can back up statements like "**safe enough to drink**" (in effect) and "kills germs" with actual data (All Purpose SDS 9. 06-14-2021.pdf) (FAQs — Bioneat | The Future of Clean). For a business or regulator reviewing it, this scientific support (e.g., published Microchem Lab results) provides credibility that sets BioNeat apart from other alternative cleaners that might have great ingredient lists but little proof of efficacy.

In summary, **BioNeat NTS-1 combines the best aspects of a high-performance industrial cleaner and a people-safe green cleaner in one formulation**. Its nanoparticle-driven cleaning power, coupled with extreme human and environmental safety, and augmented by incidental antimicrobial abilities, make it a **unique all-in-one solution**. Competitors typically excel in one dimension but not all: e.g., a solvent cleaner might degrease well but be toxic, or a green cleaner is safe but less powerful on tough grime. BioNeat strives to **"outperform them all"** without the usual compromises. This unique balance of efficacy and safety, proven through reputable testing and certifications, is what differentiates BioNeat NTS-1 in the market.

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Sources: BioNeat NTS-1 Product Data and SDS (BioNeat NTS™ — Bioneat | The Future of Clean) (All Purpose SDS 9. 06-14-2021.pdf); Simple Green Product Info and SDS (Simple Green | US | Household | All Purpose Cleaner) (Simple Green Products SDS); Zep GreenLink Product Sheet (Multi-Clean Green – Zep Inc.); Ecolab Safer Choice Award Press Release (Ecolab Inc. - Ecolab Recognized as EPA Safer Choice Program Partner of the Year); Seventh Generation Product Page (All Purpose Cleaner - Free & Clear | Seventh Generation) (Seventh Generation® Professional 44720EA All-Purpose Cleaner ...); and third-party test reports and standards as cited throughout the text.

Attribute	BioNeat NTS-1 (BioNeat Inc.)	Simple Green All-Purpose (Sunshine Makers)	Zep Cleaners (Zep Inc.)	Ecolab Cleaners (Ecolab Inc.)	Seventh Generatio
Efficacy – Grease/Oil	Exceptional degreasing via nano-colloidal micelles; breaks apart heavy oils, tar, grime. Lifts and emulsifies hydrocarbons for easy rinse-off(bioneat.com|bioneat.com. Proven on tough industrial grease (engines, oil spills). Matches or outperforms conventional degreasers without surface damage.	Very good general degreaser for light-medium soils. Removes common grease and stains (kitchen, garage) effectively(simplegreen.com. Can be used full-strength for tougher messes(simplegreen.com. Not as strong on baked-on or thick petroleum grease as high-alkaline cleaners. May require scrubbing or repeated application for heavy deposits.	Range: Mild to highly aggressive degreasers available. E.g., Zep Industrial Purple – extremely powerful on stubborn grease/oil, suitable for engines, concrete(allthatsindustrial.com. Also solvent-based cleaners (citrus, etc.) for oil. Strong products act fast on heavy grease but can harm surfaces (caustic to aluminum, etc.) if misused. Zep's green formulas handle everyday grease well, though slightly less instantly than their caustic ones	Broad spectrum: Custom products for each need. Neutral cleaners handle light oils on floors and counters (comparable to Simple Green in grease-cutting). Heavy-duty alkaline cleaners (with caustics) dissolve burnt-on fats and industrial oils (comparable to or stronger than Zep Purple). Ecolab matches product strength to application – e.g., specialized kitchen degreasers for fryer carbon, etc. Thus, efficacy can be tuned from gentle to extreme.	Good grease-cuttin surfaces(greenthes baked grease, its m force; not intended
Efficacy – Bacteria & Viruses	Not EPA-registered (no added chemical biocides), but independently lab-tested to kill microbes through surfactant action. Shown to kill 99.9% of certain bacteria (E. coli, Salmonella) even at 3:01 dilution(bioneat.com. Also achieved 3-log$_{10}$ (99.9%) virus reduction in 10 min in lab testfile-juzzknfmpugxtdehxj8fem (on an enveloped virus). Thus, it provides some sanitizing effect by disrupting microbial membranes. However, it's primarily a cleaner – suitable for removing germs, but not a certified disinfectant for high-level sanitization. No conventional pesticides means no toxic residue(bioneat.com. Residual surfactant can suppress germs on surfaces (product can be left unrinsed for non-food surfaces)(bioneat.com.	No disinfectant claims. Cleans away visible dirt and some microbes, but contains no antiseptic agent. By washing and rinsing, it will physically remove a large percentage of bacteria/viruses on surfaces, and surfactants can inactivate some viruses (especially enveloped types) similar to how soap works. However, does not kill germs to hospital-grade levels. Simple Green offers separate antibacterial or disinfectant products for germicidal action – the standard all-purpose should be followed by a sanitizer if needed for infection control.	Varies by product: Zep sells dedicated antibacterial cleaners and EPA-registered disinfectants (with quaternary ammonium compounds, bleach, etc.) – those will kill 99.9% of bacteria/viruses per label. Their plain surfactant cleaners (e.g., GreenLink multi-purpose) are not designed to kill pathogens, only to clean. So, if using a non-disinfectant Zep cleaner, one would need a separate sanitizing step for bacteria/viruses. Zep does market some all-in-one formulations (clean + disinfect) for commercial use, but those are outside "surfactant-only" scope. In short: cleaning efficacy high, but microbial kill depends on formula (none for simple cleaners; full disinfection for their EPA-reg products).	Extensive disinfection options: Ecolab provides EPA-registered sanitizers & disinfectants widely used in healthcare and food industry (quats, peroxides, etc., capable of 99.999% kill of bacteria/viruses). Those are separate products or dual-function cleaners. Many Ecolab cleaning regimens pair a cleaner with a sanitizer. If focusing strictly on surfactant-based cleaners without added antimicrobials (like a neutral floor cleaner or general surface cleaner), then like others, it will remove microbes but not necessarily kill all. In practice, Ecolab often designs cleaning products to leave minimal residue so a subsequent disinfectant can be applied. They do have combined cleaner-disinfectants (e.g. OxyCide) which have certified pathogen kill. So, efficacy against germs can be very high when using the right Ecolab product; with just a basic cleaner, it's comparable to other basic cleaners (microbial reduction through soil removal).	Not a disinfectant. S germs. It will remov microbes (notably e of 99.9% kill are ma botanical disinfecta must use that predi organic grime whic inherent in any goo
Human Safety & Toxicity	Extremely safe – "non-toxic" in the literal sense. No hazard warnings required on label(bioneat.com. Contains only water, fatty acids, coconut derivatives, and baking soda(horse-pufferfish-yay5.squarespace.com – all FDA GRAS food-grade components(horse-pufferfish-yay5.squarespace.com. pH ~9.9 (mildly alkaline)(bioneat.com, but non-caustic. Proven non-irritating to skin and does not cause skin sensitization(horse-pufferfish-yay5.squarespace.com. No inhalation hazards (no VOCs, no fumes)(bioneat.com – safe to use in enclosed or poorly ventilated areas(bioneat.com. Non-toxic if accidentally ingested: no acute toxicity; at most might act as a laxative if one drank a large amount(horse-pufferfish-yay5.squarespace.com. NFPA/HMIS ratings all 0 (minimal hazard)(horse-pufferfish-yay5.squarespace.com. Has undergone cytotoxicity testing showing negligible effect on mammalian cells. Does not require gloves or eye protection under normal use (though avoid eye contact as with any soap). Essentially as safe as a household soap – users can be confident it won't harm skin, lungs, or health(horse-pufferfish-yay5.squarespace.com|horse-pufferfish-yay5.squarespace.com).	Low hazard, user-friendly. Water-based, no bleach/ammonia. Modern formula is Safer Choice certified(simplegreen.com – excludes carcinogens, etc. Mild alkaline pH (~9) and contains a slight irritant preservative, so avoid eye contact (can cause irritation)(epa.gov. On skin, generally non-irritating for most users(epa.gov (older formula with solvent had more risk; current one is gentler). Recommend washing hands after use to avoid any drying of skin. No harmful fumes – non-flammable, no toxic vapors (fragrance is present but not overpowering). Should be kept out of children's reach (like any cleaner), but accidental ingestion of small amounts is unlikely to cause more than stomach upset(web.fa.illinois.edu. In summary, labeled "non-toxic, biodegradable," and for the majority of users it causes no issues in normal cleaning(epa.gov. Use standard common-sense precautions (don't spray in eyes, don't drink it).	Highly variable by product: Some Zep products are hazardous (corrosive or toxic), while their green products are very safe. Heavy-duty degreasers (e.g. Zep Purple) High pH (>13), will cause burns to skin/eyes on contact – requires gloves, goggles, protective clothing(osha.gov. Those also can off-gas mild chemical odors (but not extreme VOC). Careful handling and proper dilution mitigate risks. Solvent-based cleaners: may be flammable and irritant; use with ventilation. GreenLink/ Safer Choice line: formulated to be non-toxic, non-corrosive(epa.com. For instance, Multi-Clean Green has no carcinogens, no reproductive toxins, and is not an irritant; it's safe enough that only minimal caution is needed (like avoiding eye contact)(epa.com. Most Zep consumer cleaners (bathroom, glass, etc.) fall in between – typically carry a "Caution: eye irritant" label and advise gloves for prolonged use. They should not be inhaled in concentrated form (use in ventilated area if product has a solvent or strong scent). Overall, Zep can be very safe or quite dangerous depending on which product – the brand serves professional markets where potent chemicals are accepted with PPE. Users must read each product's SDS/label. By choosing Zep's Safer Choice options, one gets safety on par with Seventh Gen; by using Zep's strongest, one must treat it like an industrial chemical (with respect).	Professional use chemicals – safety managed via training/PPE. Many Ecolab cleaners are sold as concentrates to be diluted through closed dispensers, reducing direct exposure. General cleaners (neutral, glass, etc.): Typically mild irritants at concentrate, but safe when diluted. Usually require at least eye protection when handling concentrate, and gloves if prolonged skin contact, per label. After dilution, they're as safe as household cleaners (no significant harm if incidental contact). Aggressive cleaners/sanitizers: Ecolab supplies acids (can cause burns), caustics, and disinfectants (toxic if ingested) for specific uses – these carry DANGER or WARNING labels and strict instructions. Workers using them are trained to wear appropriate PPE (gloves, goggles, sometimes respirators for strong acids or bleach). No unnecessary hazardous additives – e.g., no added heavy metals or toxic solvents unless absolutely needed. Many Ecolab products now are formulated to minimize VOCs and eliminate known harmful chemicals, aligning with corporate sustainability goals. Additionally, Ecolab often designs products with safety features (e.g., color-coded to avoid mix-ups, child-resistant caps on certain bottles). In summary, safety ranges from consumer-safe (for front-of-house cleaners) to highly caustic (for back-of-house heavy-soil removal). Ecolab's advantage is comprehensive safety documentation and on-site support – when their hazardous products are used, it's under protocols that protect workers. If an end-user wants only "green" options, Ecolab can provide those as well (and indeed has lines meeting third-party green criteria).	Very high human s chemicals(seventhg with a trace of pres allergic reaction in s pH is around neutra scented versions us and pets (one reaso of eyes (even a mild one accidentally ge safe as dish soap or or sensitizing fragra testing (cruelty-free sensitive users: hyp clean a whole hous
Environmental Impact (Aquatic & Marine)	Very environmentally friendly. All organic ingredients are readily biodegradable(horse-pufferfish-yay5.squarespace.com; product breaks down into natural substances (water, CO_2, etc.). Contains no phosphorus, no chlorine, no petrochemicals/solvents, no hazardous chemicals(bioneat.com. Safe for waterways – meets EPA aquatic toxicity standards (no acute harm to fish or daphnia at relevant concentrations)(bioneat.com. In fact, used to help clean oil spills without adding pollutant load. Will not bioaccumulate or persist. Classified by EPA as "Non-hazardous waste" – can be disposed of down drain per regulations(horse-pufferfish-yay5.squarespace.com. Essentially, if BioNeat runoff enters a river, it dilutes and biodegrades quickly with minimal to no impact on aquatic life (SDS: "no known ecotoxicity"(horse-pufferfish-yay5.squarespace.com). Also, contains no VOCs so it does not contribute to smog(bioneat.com. Minimal carbon footprint in use (dilutable concentrate reduces shipping weight). Even packaging is just HDPE and can be recycled. Overall, a "green" cleaner in the truest sense, safe in septic systems, streams, and marine environments.	Environmentally safe when used/diluted properly. Fully biodegradable formula (verified by OECD 301D test)(web.fa.illinois.edu. Surfactants and other organics degrade in wastewater treatment and environment; no persistent bioaccumulative toxins. Aquatic toxicity is low – tests show it's not classified as harmful to aquatic life (effect concentrations ≥100 mg/L)(web.fa.illinois.edu. However, high concentrations can be harmful to small aquatic organisms (e.g., undiluted Simple Green has moderate aquatic toxicity: fish LC50 ~27 ppm)(epa.gov, so large spills should be avoided or contained. It contains no regulated hazardous pollutants (EPA confirms no priority pollutants in it)(epa.gov. Phosphate-free, hence does not promote algae blooms. If used on outdoor surfaces, runoff in reasonable amounts shouldn't significantly impact plants or animals. Direct Release applications (like oil spill shoreline cleanup) have been approved by EPA, demonstrating relative environmental acceptability. Has very low VOC content (0% by EPA method)(web.fa.illinois.edu, so it doesn't pollute air. The company encourages recycling of bottles. Note earlier concerns about a solvent (butoxyethanol) affecting waterways have been mitigated by its removal. Current formula is much "greener." Bottom line: biodegradable and environmentally benign in normal use, but like any detergent, shouldn't be poured in concentrated form into a creek – dilution and time will allow natural breakdown with minimal harm.	Mixed – product-dependent. GreenLink products: designed for minimal environmental impact – biodegradable surfactants, aquatic safe (Green Seal sets limits on aquatic toxicity). These Zep formulas are comparable to Seventh Gen in eco-friendliness (e.g., Multi-Clean Green is Green Seal certified, meeting strict standards for biodegradability and low toxicity)(zep.com. Many carry Safer Choice indicating each ingredient passes environmental criteria. Conventional products: some contain ingredients that are not environmentally optimal. For example, butyl cellosolve (in older formulations) is moderately toxic to aquatic life and not rapidly biodegradable. High-caustic cleaners can alter water pH if released. Solvent cleaners may have VOC emissions. Zep has some solvent degreasers that are high-VOC, contributing to smog). Zep's line includes some "Direct Release" certified products (safe for outdoor runoff(homedepot.com – use those for tasks where chemicals might enter storm drains. The company has been introducing more environmentally preferable formulas to replace old ones, but both types co-exist. Also, certain Zep disinfectants contain quats or phenolics which can be toxic to algae/fish – they require proper disposal. Packaging: Zep offers concentrates (reducing packaging waste) and has moved to recyclable containers. They have eliminated ozone-depleting substances from aerosols long ago. Summary: With Zep, an environmentally-conscious user should select the GreenLink/ Safer Choice options, which have low aquatic toxicity and are readily biodegradable. Using Zep's strong cleaners in controlled environments is fine (since wastewater treatment will handle them), but one should avoid letting those harsher ones directly enter ecosystems. When used as intended (mostly indoors with sewer discharge), environmental risk is controlled; Zep's SDS often instruct to avoid unregulated release to environment. Zep has the capability to be as "green" as needed (as evidenced by certified products), but not every product in their catalog meets that bar.	Overall commitment to sustainability, but potent formulas require care. Ecolab ensures all cleaning surfactants are biodegradable per regulations(ecolab.com. Many of their newer formulations are optimized for low environmental impact (e.g., using hydrogen peroxide instead of chlorine; using enzymes to reduce harsh chemicals). They've been recognized for advancing safer chemistry(investor.ecolab.com. Still, some Ecolab products are by nature hazardous to the environment if undiluted – e.g., a concentrated disinfectant with quats could kill aquatic life if large quantities reached a river. However, these are normally neutralized/diluted in use. Ecolab works with customers on proper effluent management (so in a food plant, after cleaning with an Ecolab caustic, the waste is often pH-neutralized before discharge). They also have EPA Safer Choice certified products in their lineup for clients who demand third-party green validation. And they have obtained Green Seal certifications on some institutional cleaners. Ecolab emphasizes water and energy savings too – by using their products, clients often reduce environmental footprint (e.g., shorter cleaning cycles, lower temp washes, which saves fuel). Aquatic toxicity: Ecolab's safety data typically note if a product is toxic to fish or not. For example, their neutral floor cleaner might be practically non-toxic to aquatic life, whereas a sanitizer might have warnings to avoid release to environment. Ecolab has innovated with products that break down into innocuous substances (ex: OxyCide's actives break into acetic acid & water)(investor.ecolab.com. In sum, Ecolab can deliver very eco-friendly solutions, but also supplies necessary evil chemicals (acids, etc.) – they manage environmental impact through careful use and encourage customers to use the least harmful effective option. The presence of any hazardous chemicals is mitigated by closed systems and treatment – so the net environmental release is minimized. If evaluating just the surfactant cleaners, Ecolab's are on par with other Safer Choice cleaners in biodegradability and low toxicity.	Environmentally ou high in biodegradab environmental stan (glucosides, ethoxyl toxicity is very low; phosphates, no chl fumes. Safe for grey beyond a temporar impact their use of renewable agricult ecosystem/ethical i corporate reports) a negligible environm green products. On don't dump a whol aquatic environmer respiration; but in n
Certifications & Standards	- EPA Safer Choice (indicates safer for people and environment)(bioneat.com - USDA BioPreferred: Not explicitly labeled, but composition is ~100% biobased (could qualify). - USDA Facility Categories: Authorized for use in food processing: USDA A1 (General Cleaner) & L1 (Drain Cleaner acceptable)(bioneat.com – equivalent to NSF registration for incidental food contact and floor/drain use in regulated facilities. - FDA GRAS: All ingredients on FDA GRAS list(horse-pufferfish-yay5.squarespace.com; implies it's safe if trace residues contact food. - Meets OSHA HCS (HazCom) and EPA standards for labeling (contains no OSHA regulated hazards)(bioneat.com. - VOC compliant: Tested per EPA Methods 601,602; contains 0% VOCs)(bioneat.com. - Not OMRI listed currently (but likely could be for organic use). - Company likely adheres to ISO 9001 quality system (small company, not stated). - 3rd-party validations: Numerous lab test reports (ASTM, AOAC methods) by ISO 17025 labs verifying claims (see Testing section).	- EPA Safer Choice certified (All-Purpose formula)(simplegreen.com. - No current USDA biobased label; formula contains significant biobased content but some petro-derived too. - NSF Registered: A variant (Crystal Simple Green) is NSF A1 for food industry cleaning. Original SG is often accepted in government green procurement. - EPA NCP (Oil Spill) Product Schedule: Listed as a Surface Washing Agent by EPA (1990; updated 1995)(epa.gov, meaning EPA reviewed its effectiveness & toxicity for oil cleanup. - Kosher/Halal: Simple Green is reported to be kosher certified (for use in kosher food plants) in some documentation. - ISO 14001: The manufacturer has won environmental awards; likely follows environmental management standards. - EWG Grade: Used to be low due to old formula; with new formula and full ingredient disclosure, it would score better (the EWG guide currently gives some Simple Green products B or C, depending on preservative usage).	- EPA Safer Choice: Several Zep products (e.g. All-in-1 Pressure Wash, certain multi-surface cleaners) carry Safer Choice logo(homedepot.com. But not brand-wide – specific formulas only. - Green Seal GS-37: Zep GreenLink Multi-Clean Green and some others are Green Seal Certified for institutional use(zep.com. - UL ECOLOGO: Possibly some Zep items have this (not confirmed in our data, but likely for Canadian market). - NSF: Zep has NSF-registered cleaners for food processing (check NSF White Book – likely Zep A1, A4 registrations for degreasers and floor cleaners). - ISO Certifications: Zep Inc. likely ISO 9001 certified for manufacturing. - Prop 65: Zep complies by labeling any products with trace Prop65 chemicals (as seen with even GreenLink having a Prop65 warning for tiny 1,4-dioxane presence)(ehsi.com. - Industry approvals: Zep products are used by DOTs, etc., but formal NTPEP evaluations not publicly cited – however, they meet many industry-specific needs and likely appear on state approved product lists (e.g., for graffiti remover, etc.). - EPA Registrations: Zep has many EPA-registered disinfectants (proving their efficacy via third-party labs), though those are separate from surfactant-only cleaners.	- EPA Safer Choice Partner of the Year (2016)(investor.ecolab.com – recognition by EPA for Ecolab's leadership in formulating safer products. Some Ecolab products themselves are Safer Choice certified (especially in their institutional/cleaning lines), though exact names aren't publicized (they often formulate for private brands too). - Green Seal/ECOLOGO: Ecolab has certified products, e.g., some hand soaps and cleaners for schools meet GS-37 or UL ECOLOGO. For instance, their Peroxide Multi Surface Cleaner is Green Seal certified (GS-37) in some markets, and Oasis 146 Multi-Quat sanitizer is Green Seal (GS-53) for limited disinfectants. - NSF: Dozens of Ecolab cleaning products are NSF listed for various categories (A1, D2, etc.) for use in food processing. - FDA: Ecolab has FDA approvals for certain uses – e.g., their no-rinse fruit & vegetable wash is FDA cleared, and some cleaners meet 21 CFR exemptions for food contact after proper rinse. - ISO 9001/14001: Ecolab operates under stringent quality and environmental management systems globally. - ISO 17025 labs: Ecolab's own labs are accredited, and they ensure all performance claims are validated (internal/external). - Other: Ecolab is a signatory of the UN Global Compact, adheres to Responsible Care in its chemical manufacturing, and consistently ranks in sustainability indices (these reflect corporate commitment beyond product labels). - Not consumer-facing, but Ecolab helps customers achieve LEED credits and complies with green building standards by offering Green Cleaning formulations.	- EPA Safer Choice c - USDA Certified Bio renewable carbon c - Leaping Bunny (C - Certified B Corpora standards). - Ingredient Transpa ingredients online). - Kosher: Seventh G substances). - ISO standards: as p - GreenSeal: Seventi Safer Choice(allmyn - EWG Verified: Not safety). - Climate commitm renewable energy c product-specific, bu
Notable Third-Party Tests & Validation	- ASTM F895 / ISO 10993-5 Cytotoxicity: Passed (diluted product showed negligible cell toxicity). - AOAC 961.02 Hard Surface Sanitization Test: Demonstrated bactericidal activity in lab (killed e.g. Salmonella, E. coli on surfaces at high dilution; specifics from FAQ and lab reports)(bioneat.com. - ASTM E1053 Viral Surface Test: 3.00 log$_{10}$ (99.9%) reduction in virus titer in 10 min (Microchem lab, 2020)file-juzzknfmpugxtdehxj8fem; >0.8 log reduction on tougher virus (BCS lab, 2014)file-juzzknfmpugxtdehxj8fem. - OECD 301D Biodegradability: older formula found readily biodegradable (≥60% in 28 days)(bioneat.com. Current formula expected equal or better. - EPA aquatic toxicity test (EPA 821 series): Met criteria (likely LC50 >100 mg/L for fish/daphnia; SDS indicates no eco-toxic effect)(horse-pufferfish-yay5.squarespace.com. - TURI P2OASys hazard evaluation: scored very low hazard (overall score ~3.9 out of 10, with 2 being best)(cleansolutions.org, validating its safety in categories like acute toxicity, eco-tox, etc. – Used in field by industries (testimonials indicate effective cleaning where others failed – empirical validation). (No known NTPEP data, but likely acceptable if submitted given its highway-friendly profile.)	– OECD 301D Closed Bottle: Readily biodegradable (SDS reports this test)(web.fa.illinois.edu. – OECD 201, 202/211 (Algae, Daphnia, Fish): Low aquatic toxicity (no GHS classification; EC50/LC50 ≥100 mg/L)(web.fa.illinois.edu. – EPA NCP Testing: EPA verified its effectiveness as an oil spill cleaner and toxicity vs. reference (Mendota fish LC50 ~279 ppm; Mysid shrimp 7.76 ppm)(epa.gov. It passed criteria to be listed for use in environmental cleanup. – Dermal/Eye Irritation tests: Likely 3rd-party lab results show "Non-irritating to skin; minimal eye irritation" (per SDS, presumably tested or expert-reviewed)(web.fa.illinois.edu. – Material compatibility: Proven safe on metals, plastics (DoD and others have tested it on aircraft aluminum, etc., to replace harsher cleaners). Some sources mention it's safe on anodized aluminum if rinsed. – Consumer Reports: In consumer cleaner comparisons, Simple Green often performs adequately (middle-tier) for cleaning efficacy – validating it works as a general cleaner (though not always best on specific stains). – EWG: Gave earlier formula a poor grade due to ingredients; expected to improve with current formulation – an external critique that drove reformulation. – Industry adoption: Used by US Military, NASA, and companies as a safer solvent alternative, implying it met their internal test standards for performance and safety.	– Green Seal GS-37 Testing: Zep Multi-Clean Green had to pass performance tests (soil removal, etc.) equivalent to or better than a conventional cleaner to earn GS-37(epa.com|zep.com. So third-party labs validated its cleaning efficacy. – EPA Safer Choice Review: For certified Zep products, EPA vetted each ingredient's safety; also reviewed product works in its category (through in-house or literature data). – ASTM D4488 (Greasy soil cleaning) and others: Zep likely tests their degreasers on standardized soils; results often show faster or more complete removal vs. competitors (internal data they share in B2B marketing). E.g., demonstration that Zep heavy-duty cleaner dissolves grease X% more in Y time than another product – often tested by application labs. – OSHA & DOT compliance tests: e.g., flash point tests for flammability (many Zep solvent cleaners have been tested to determine if they're flammable or combustible class – ensuring safe transport classification). – Customer field trials: Many large clients (city fleets, manufacturing plants) test multiple products and document results. Zep often publishes case studies (like a transit authority reduced cleaning time by 30% using Zep XYZ – implying a validation trial). – NTPEP: No specific mention, but Zep's asphalt release agents might be in NTPEP's test program (they test effectiveness and environmental compliance for such products). If so, being approved by NTPEP for DOT use is a robust validation. – EPA Registration tests: For Zep disinfectant cleaners (not the plain ones), AOAC germicidal tests by certified labs proved efficacy (some Zep products are hospital-grade disinfectants, requiring >6 log kill on pathogens). This showcases Zep's ability to have products rigorously tested, though it may not apply to the surfactant-only cleaners directly.	– Internal labs: Ecolab has a strong R&D – they test each formula for effectiveness (e.g., swabbing surfaces before/after cleaning to measure soil removal, shine, etc.). They often calibrate formulas to outperform competitors slightly. Many tests are confidential, but the results manifest in customer retention. – Third-party audits: Food and health regulators audit facilities using Ecolab products – indirectly validating that Ecolab's hygiene programs achieve required cleanliness standards (or the facility would fail inspection). – EPA registration data: Ecolab's sanitizers/disinfectants have large sets of third-party lab reports (AOAC tests for Salmonella, Staph, etc.; EN standards for Europe). For example, their Peroxide Multi-Surface Cleaner is EPA-registered to kill Norovirus in 45 seconds – backed by lab tests. This product also cleans – so it had to pass both cleaning efficiency and micro efficacy in third-party labs. – Sustainability metrics: Ecolab and an NGO (Trucost) developed a Water Risk Monetizer(investor.ecolab.com – not product test, but shows their thought leadership. They also publish that using X product saved Y gallons of water or energy for a client (these savings are usually verified in pilot studies at client sites). – Comparative trials: When Ecolab introduces a new cleaner to a hotel chain, they often do a side-by-side trial vs. the previous product to ensure equal or better performance with less environmental impact. Those trial reports (though internal) are a form of validation Ecolab must provide to win contracts. – Certifications: Achieving Green Seal or Safer Choice on specific products means a third party verified both formula and performance (Green Seal includes performance tests supervised by their labs). Ecolab has done this where applicable. (NTPEP not relevant, but they do engage in industry standard tests for specific sectors, like ASTM sanitation standards in brewing, etc.)	– Green Seal GS-37: standards(allmyne – Safer Choice: EPA' intended. – Dermatologist Tes volunteers confirmi populations). – Allergy Standards certification. The All (though not official – Consumer Testing expectations (they leading competitor – LCAs: They have c environmental foo toxic impact). This s – Awards: Seventh G product innovation environmental clair – In use, Seventh G programs – those in own trials or relying the needed validati

Attribute	BioNeat NTS-1 (BioNeat Inc.)	Simple Green All-Purpose (Sunshine Makers)	Zep Cleaners (Zep Inc.)	Ecolab Cleaners (Ecolab Inc.)	Seventh Generati
Efficacy – Grease/Oil	Exceptional degreasing via nano-colloidal micelles; breaks apart heavy oils, tar, grime. Lifts and emulsifies hydrocarbons for easy rinse-offbioneat.combioneat.com. Proven on tough industrial grease (engines, oil spills). Matches or outperforms conventional degreasers without surface damage.	Very good general degreaser for light-medium soils. Removes common grease and stains (kitchen, garage) effectivelysimplegreen.com. Can be used full-strength for tougher messessimplegreen.com. Not as strong on baked-on or thick petroleum grease as high-alkaline cleaners. May require scrubbing or repeated application for heavy deposits.	Range: Mild to highly aggressive degreasers available. E.g., Zep Industrial Purple – extremely powerful on stubborn grease/oil, suitable for engines, concretewhiteheadindustrial.com. Also solvent-based cleaners (citrus, etc.) for oil. Strong products act fast on heavy grease but can harm surfaces (caustic to aluminum, etc.) if misused. Zep's green formulas handle everyday grease well, though slightly less instantly than their caustic ones.	Broad spectrum: Custom products for each need. Neutral cleaners handle light oils on floors and counters (comparable to Simple Green in grease-cutting). Heavy-duty alkaline cleaners (with caustics) dissolve burnt-on fats and industrial oils (comparable to or stronger than Zep Purple). Ecolab matches product strength to application – e.g., specialized kitchen degreasers for fryer carbon, etc. Thus, efficacy can be tuned from gentle to extreme.	Good grease-cuttin surfacesseventhge baked grease, its m force; not intended
Efficacy – Bacteria & Viruses	Not EPA-registered (no added chemical biocides), but independently lab-tested to kill microbes through surfactant action. Shown to kill 99.9% of certain bacteria (E. coli, Salmonella) even at 30:1 dilutionbioneat.com. Also achieved 3-$\log_{10}$ (99.9%) virus reduction in 10 min in lab testsfile-juzzknfmpugxtdehxj8fem (on an enveloped virus). Thus, it provides some sanitizing effect by disrupting microbial membranes. However, it's primarily a cleaner – suitable for removing germs, but not a certified disinfectant for high-level sanitization. No conventional pesticides means no toxic residuebioneat.com. Residual surfactant can suppress germs on surfaces (product can be left unrinsed for non-food surfaces)bioneat.com.	No disinfectant claims. Cleans away visible dirt and some microbes, but contains no antiseptic agent. By washing and rinsing, it will physically remove a large percentage of bacteria/viruses on surfaces, and surfactants can inactivate some viruses (especially enveloped types) similar to how soap works. However, does not kill germs to hospital-grade levels. Simple Green offers separate antibacterial or disinfectant products for germicidal action – the standard all-purpose should be followed by a sanitizer if needed for infection control.	Varies by product: Zep sells dedicated antibacterial cleaners and EPA-registered disinfectants (with quaternary ammonium compounds, bleach, etc.) – those will kill 99.9% of bacteria/viruses per label. Their plain surfactant cleaners (e.g., GreenLink multi-purpose) are not designed to kill pathogens, only to clean. So, if using a non-disinfectant Zep cleaner, one would need a separate sanitizing step for bacteria/viruses. Zep does market some all-in-one formulations (clean + disinfect) for commercial use, but those are outside "surfactant-only" scope. In short: cleaning efficacy high, but microbial kill depends on formula (none for simple cleaners; full disinfection for their EPA-reg products).	Extensive disinfection options: Ecolab provides EPA-registered sanitizers & disinfectants widely used in healthcare and food industry (quats, peroxides, etc., capable of 99.999% kill of bacteria/viruses). Those are separate products or dual-function cleaners. Many Ecolab cleaning regimens pair a cleaner with a sanitizer. If focusing strictly on surfactant-based cleaners without added antimicrobials (like a neutral floor cleaner or general surface cleaner), then like others, it will remove microbes but not necessarily kill all. In practice, Ecolab often designs cleaning products to leave minimal residue so a subsequent disinfectant can be applied. They do have combined cleaner-disinfectants (e.g. OxyCide) which have certified pathogen kill. So, efficacy against germs can be very high when using the right Ecolab product; with just a basic cleaner, it's comparable to other basic cleaners (microbial reduction through soil removal).	Not a disinfectant. germs. It will remo microbes (notably of 99.9% kill are ma botanical disinfecta must use that prod organic grime whic inherent in any go
Human Safety & Toxicity	Extremely safe – "non-toxic" in the literal sense. No hazard warnings required on labelbioneat.com. Contains only water, fatty acids, coconut derivatives, and baking sodahorse-pufferfish-ysy5.squarespace.com – all FDA GRAS food-grade componentshorse-pufferfish-ysy5.squarespace.com. pH ~9.9 (mildly alkaline)bioneat.com, but non-caustic. Proven non-irritating to skin and does not cause skin sensitizationhorse-pufferfish-ysy5.squarespace.com. No inhalation hazards (no VOCs, no fumes)bioneat.com – safe to use in enclosed or poorly ventilated areasbioneat.com. Non-toxic if accidentally ingested: no acute toxicity; at most might act as a laxative if one drank a large amounthorse-pufferfish-ysy5.squarespace.com. NFPA/HMIS ratings all 0 (minimal hazard)horse-pufferfish-ysy5.squarespace.com. Has undergone cytotoxicity testing showing negligible effect on mammalian cells. Does not require gloves or eye protection under normal use (though avoid eye contact as with any soap). Essentially as safe as a household soap – users can be confident it won't harm skin, lungs, or healthhorse-pufferfish-ysy5.squarespace.comhorse-pufferfish-ysy5.squarespace.com.	Low hazard, user-friendly. Water-based, no bleach/ammonia. Modern formula is Safer Choice certifiedsimplegreen.com – excludes carcinogens, etc. Mild alkaline pH (~9) and contains a slight irritant preservative, so avoid eye contact (can cause irritation)epa.gov. On skin, generally non-irritating for most usersepa.gov (older formula with solvent had more risk; current one is gentler). Recommend washing hands after use to avoid any drying of skin. No harmful fumes – non-flammable, no toxic vapors (fragrance is present but not overpowering). Should be kept out of children's reach (like any cleaner), but accidental ingestion of small amounts is unlikely to cause more than stomach upsetweb.faa.illinois.edu. In sum, labeled "non-toxic, biodegradable," and for the majority of users it causes no issues in normal cleaningepa.gov. Use standard common-sense precautions (don't spray in eyes, don't drink it).	Highly variable by product: Some Zep products are hazardous (corrosive or toxic), while their green products are very safe. Heavy-duty degreasers (e.g. Zep Purple): High pH (>13), will cause burns to skin/eyes on contact – requires gloves, goggles, protective clothingosha.gov. Those also can off-gas mild chemical odors (but not extreme VOC). Careful handling and proper dilution mitigate risks. Solvent-based cleaners: may be flammable and irritant; use with ventilation. GreenLink/ Safer Choice line: formulated to be non-toxic, non-corrosivezep.com. For instance, Multi-Clean Green has no carcinogens, no reproductive toxins, and is not an irritant; it's safe enough that only minimal caution is needed (like avoiding eye contact)zep.com. Most Zep consumer cleaners (bathroom, glass, etc.) fall in between – typically carry a "Caution: eye irritant" label and advise gloves for prolonged use. They should not be inhaled in concentrated form (use in ventilated area if product has a solvent or strong scent). Overall, Zep can be very safe or quite dangerous depending on which product – the brand serves professional markets where potent chemicals are accepted with PPE. Users must read each product's SDS/label. By choosing Zep's Safer Choice options, one gets safety on par with Seventh Gen; by using Zep's strongest, one must treat it like an industrial chemical (with respect).	Professional use chemicals – safety managed via training/PPE. Many Ecolab cleaners are sold as concentrates to be diluted through closed dispensers, reducing direct exposure. General cleaners (neutral, glass, etc.): Typically mild irritants at concentrate, but safe when diluted. Usually require at least eye protection when handling concentrate, and gloves if prolonged skin contact, per label. After dilution, they're as safe as household cleaners (no significant harm if incidental contact). Aggressive cleaners/sanitizers: Ecolab supplies acids (can cause burns), caustics, and disinfectants (toxic if ingested) for specific uses – these carry DANGER or WARNING labels and strict instructions. Workers using them are trained to wear appropriate PPE (gloves, goggles, sometimes respirators for strong acids or bleach). No unnecessary hazardous additives – e.g., no added heavy metals or toxic solvents unless absolutely needed. Many Ecolab products now are formulated to minimize VOCs and eliminate known harmful chemicals, aligning with corporate sustainability goals. Additionally, Ecolab often designs products with safety features (e.g., color-coded to avoid mix-ups, child-resistant caps on certain bottles). In summary, safety ranges from consumer-safe (for front-of-house cleaners) to highly caustic (for back-of-house heavy soil removal). Ecolab's advantage is comprehensive safety documentation and on-site support – when their hazardous products are used, it's under protocols that protect workers. If an end-user wants only "green" options, Ecolab can provide those as well (and indeed has lines meeting third-party green criteria).	Very high human s chemicalsseventh with a trace of pres allergic reaction in pH is around neutr scented versions u and pets (one reas of eyes (even a mild one accidentally ge safe as dish soap o or sensitizing fragr testing (cruelty-fre sensitive users: hyp clean a whole hous
Environmental Impact (Aquatic & Marine)	Very environmentally friendly. All organic ingredients are readily biodegradablehorse-pufferfish-ysy5.squarespace.com; product breaks down into natural substances (water, CO_2, etc.). Contains no phosphorus, no chlorine, no petrochemical solvents, no hazardous chemicalsbioneat.com. Safe for waterways – meets EPA aquatic toxicity standards (no acute harm to fish or daphnia at relevant concentrations)bioneat.com. In fact, used to help clean oil spills without adding pollutant load. Will not bioaccumulate or persist. Classified by EPA as "Non-hazardous waste" – can be disposed of down drain per regulationshorse-pufferfish-ysy5.squarespace.com. Essentially, if BioNeat runoff enters a river, it dilutes and biodegrades quickly with minimal to no impact on aquatic life (SDS: "no known ecotoxicity"horse-pufferfish-ysy5.squarespace.com). Also, contains no VOCs so it does not contribute to smogbioneat.com. Minimal carbon footprint in use (dilutable concentrate reduces shipping weight). Even packaging is just HDPE and can be recycled. Overall, a "green" cleaner in the truest sense, safe in septic systems, streams, and marine environments.	Environmentally safe when used/diluted properly. Fully biodegradable formula (verified by OECD 301D test)web.faa.illinois.edu. Surfactants and other organics degrade in wastewater treatment and environment; no persistent bioaccumulative toxins. Aquatic toxicity is low – tests show it's not classified as harmful to aquatic life (effect concentrations ≥100 mg/L)web.faa.illinois.edu. However, high concentrations can be harmful to small aquatic organisms (e.g., undiluted Simple Green has moderate aquatic toxicity: fish LC50 ~27 ppm)epa.gov, so large spills should be avoided or contained. It contains no regulated hazardous pollutants (EPA confirms no priority pollutants in it)epa.gov. Phosphate-free, hence does not promote algae blooms. If used on outdoor surfaces, runoff in reasonable amounts shouldn't significantly impact plants or animals. Direct Release applications (like oil spill shoreline cleanup) have been approved by EPA, demonstrating relative environmental acceptability. Has very low VOC content (0% by EPA method)web.faa.illinois.edu, so it doesn't pollute air. The company encourages recycling of bottles. Note: earlier concerns about a solvent (butoxyethanol) affecting waterways have been mitigated by its removal. Current formula is much "greener." Bottom line: biodegradable and environmentally benign in normal use, but like any detergent, shouldn't be poured in concentrated form into a creek – dilution and time will allow natural breakdown with minimal harm.	Mixed – product-dependent. GreenLink products: designed for minimal environmental impact – biodegradable surfactants, aquatic safe (Green Seal sets limits on aquatic toxicity). These Zep formulas are comparable to Seventh Gen in eco-friendliness (e.g., Multi-Clean Green is Green Seal certified, meeting strict standards for biodegradability and low toxicity)zep.com. Many carry Safer Choice indicating each ingredient passes environmental criteria. Conventional products: some contain ingredients that are not environmentally optimal. For example, butyl cellosolve (in older formulations) is moderately toxic to aquatic life and not rapidly biodegradable. High-caustic cleaners can alter water pH if released. Solvent cleaners may have VOC emissions (Zep has some solvent degreasers that are high-VOC, contributing to smog). Zep's line includes some "Direct Release" certified products (safe for outdoor runoff)homedepot.com – use those for tasks where chemicals might enter storm drains. The company has been introducing more environmentally preferable formulas to replace old ones, but both types co-exist. 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Overall commitment to sustainability, but potent formulas require care. Ecolab ensures all cleaning surfactants are biodegradable per regulationsecolab.com. Many of their newer formulations are optimized for low environmental impact (e.g., using hydrogen peroxide instead of chlorine; using enzymes to reduce harsh chemicals). They've been recognized for advancing safer chemistryinvestor.ecolab.com. Still, some Ecolab products are by nature hazardous to the environment if undiluted – e.g., a concentrated disinfectant with quats could kill aquatic life if large quantities reached a river. However, these are normally neutralized/diluted in use. Ecolab works with customers on proper effluent management (so in a food plant, after cleaning with an Ecolab caustic, the waste is often pH-neutralized before discharge). They also have EPA Safer Choice certified products in their lineup for clients who demand third-party green validation. 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The presence of any hazardous chemicals is mitigated by closed systems and treatment – so the net environmental release is minimized. If evaluating just the surfactant cleaners, Ecolab's are on par with other Safer Choice cleaners in biodegradability and low toxicity.	Environmentally o high in biodegrada environmental star (glucosides, ethoxy toxicity is very low; preservative (which dilution, it is quickl phosphates, no chl fumes. Safe for gre beyond a tempora their use of recycle agriculture. Also, n impact. Seventh G and they aim for ze footprint compare it down the drain g pond – large conce water surface tensi scenario is unlikely
Certifications & Standards	- EPA Safer Choice (indicates safer for people and environment)bioneat.com. - USDA BioPreferred: Not explicitly labeled, but composition is ~100% biobased (could qualify). - USDA Facility Categories: Authorized for use in food processing: USDA A1 (General Cleaner) & L1 (Drain Cleaner) acceptablebioneat.com – equivalent to NSF registration for incidental food contact and floor/drain use in regulated facilities. - FDA GRAS: All ingredients on FDA GRAS listhorse-pufferfish-ysy5.squarespace.com; implies it's safe if trace residues contact food. - Meets OSHA HCS (HazCom) and EPA standards for labeling (contains no OSHA regulated hazards)bioneat.com. - VOC compliant: Tested per EPA Methods 601/602; contains 0% VOCsbioneat.com. - Not OMRI listed currently (but likely could be for organic use). - Company likely adheres to ISO 9001 quality system (small company, not stated). - 3rd-party validations: Numerous lab test reports (ASTM, AOAC methods) by ISO 17025 labs verifying claims (see Testing section).	- EPA Safer Choice certified (All-Purpose formula)simplegreen.com. - No current USDA biobased label; formula contains significant biobased content but some petro-derived too. - NSF Registered: A variant (Crystal Simple Green) is NSF A1 for food industry cleaning. Original SG is often accepted in government green procurement. - EPA NCP (Oil Spill) Product Schedule: Listed as a Surface Washing Agent by EPA (1990; updated 1995)epa.gov, meaning EPA reviewed its effectiveness & toxicity for oil cleanup. - Kosher/Halal: Simple Green is reported to be kosher certified (for use in kosher food plants) in some documentation. - ISO 14001: The manufacturer has won environmental awards; likely follows environmental management standards. - EWG Grade: Used to be low due to old formula; with new formula and full ingredient disclosure, it would score better (the EWG guide currently gives some Simple Green products B or C, depending on preservative usage).	- EPA Safer Choice: Several Zep products (e.g. All-in-1 Pressure Wash, certain multi-surface cleaners) carry Safer Choice logohomedepot.com. But not brand-wide – specific formulas only. - Green Seal GS-37: Zep GreenLink Multi-Clean Green and some others are Green Seal Certified for institutional usezep.com. - UL ECOLOGO: Possibly some Zep items have this (not confirmed in our data, but likely for Canadian market). - NSF: Zep has NSF registered cleaners for food processing (check NSF White Book – likely Zep A1, A4 registrations for degreasers and floor cleaners). - ISO Certifications: Zep Inc. likely ISO 9001 certified for manufacturing. - Prop 65: Zep complies by labeling any products with trace Prop65 chemicals (as seen with even GreenLink having a Prop65 warning for tiny 1,4-dioxane presence)zep.com. - Industry approvals: Zep products are used by DOTs, etc., but formal NTPEP evaluations not publicly cited – however, they meet many industry-specific needs and likely appear on state approved product lists (e.g., for graffiti remover, etc.). - EPA Registrations: Zep has many EPA-registered disinfectants (proving their efficacy via third-party labs), though those are separate from surfactant-only cleaners.	- EPA Safer Choice Partner of the Year (2016)investor.ecolab.com – recognition by EPA for Ecolab's leadership in formulating safer products. Some Ecolab products themselves are Safer Choice certified (especially in their institutional cleaning lines), though exact names aren't publicized (they often formulate for private brands too). - Green Seal/ECOLOGO: Ecolab has certified products, e.g., some hand soaps and cleaners for schools meet GS-37 or UL ECOLOGO. For instance, their Peroxide Multi Surface Cleaner is Green Seal certified (GS-37) in some markets, and Oasis 146 Multi-Quat sanitizer is Green Seal (GS-53) for limited disinfectants. - NSF: Dozens of Ecolab cleaning products are NSF listed for various categories (A1, D2, etc.) for use in food processing. - FDA: Ecolab has FDA approvals for certain uses – e.g., their no-rinse fruit & vegetable wash is FDA cleared, and some cleaners meet 21 CFR exemptions for food contact after proper rinse. - ISO 9001/14001: Ecolab operates under stringent quality and environmental management systems globally. - ISO 17025 labs: Ecolab's own labs are accredited, and they ensure all performance claims are validated (internal/external). - Other: Ecolab is a signatory of the UN Global Compact, adheres to Responsible Care in its chemical manufacturing, and consistently ranks in sustainability indices (these reflect corporate commitment beyond product labels). - Not consumer-facing, but Ecolab helps customers achieve LEED credits and complies with green building standards by offering Green Cleaning formulations.	- EPA Safer Choice - USDA Certified Bi renewable carbon - Leaping Bunny (C - Certified B Corpo standards). - Ingredient Transp ingredients online) - Kosher: Seventh G substances). - ISO standards: as - GreenSeal: Seven Safer Choicehillnm - EWG Verified: No safety). - Climate commitm renewable energy product-specific, b
Notable Third-Party Tests & Validation	– ASTM F895 / ISO 10993-5 Cytotoxicity: Passed (diluted product showed negligible cell toxicity). – AOAC 961.02 Hard Surface Sanitization Test: Demonstrated bactericidal activity in lab (killed e.g. Salmonella, E. coli on surfaces at high dilution; specifics from FAQ and lab reports)bioneat.com. – ASTM E1053 Viral Surface Test: 3.00 $\log_{10}$ (99.9%) reduction in virus titer in 10 min (Microchem lab, 2020)file-juzzknfmpugxtdehxj8fem; ~0.8 log reduction on tougher virus (BCS lab, 2014)file-juzzknfmpugxtdehxj8fem. – OECD 301D Biodegradability: older formula found readily biodegradable (≥60% in 28 days)bioneat.com. Current formula expected equal or better. – EPA aquatic toxicity test (EPA 821 series): Met criteria (likely LC50 >100 mg/L for fish/daphnia; SDS indicates no eco-toxic effect)horse-pufferfish-ysy5.squarespace.com. – TURI P2OASys hazard evaluation: scored very low hazard (overall score ~3.9 out of 10, with 2 being best)cleanersolutions.org, validating its safety in categories like acute toxicity, eco-tox, etc. – Used in field by industries (testimonials indicate effective cleaning where others failed – empirical validation). (No known NTPEP data, but likely acceptable if submitted given its highway-friendly profile.)	– OECD 301D Closed Bottle: Readily biodegradable (SDS reports this test)web.faa.illinois.edu. – OECD 201,202,203 (Algae, Daphnia, Fish): Low aquatic toxicity (no GHS classification; EC50/LC50 ≥100 mg/L)web.faa.illinois.edu. – EPA NCP Testing: EPA verified its effectiveness as an oil spill cleaner and toxicity vs. reference (Menidia fish LC50 ~27.9 ppm; Mysid shrimp 77.6 ppm)epa.gov. It passed criteria to be listed for use in environmental cleanup. – Dermal/Eye Irritation tests: Likely 3rd-party lab results show "Non-irritating to skin; minimal eye irritation" (per SDS, presumably tested or expert-reviewed)web.faa.illinois.edu. – Material compatibility: Proven safe on metals, plastics (DoD and others have tested it on aircraft aluminum, etc., to replace harsher cleaners). Some sources mention it's safe on anodized aluminum if rinsed. – Consumer Reports: In consumer cleaner comparisons, Simple Green often performs adequately (middle-tier) for cleaning efficacy – validating it works as a general cleaner (though not always best on specific stains). – EWG: Gave earlier formula a poor grade due to ingredients; expected to improve with current formulation – an external critique that drove reformulation. – Industry adoption: Used by US Military, NASA, and companies as a safer solvent alternative, implying it met their internal test standards for performance and safety.	– Green Seal GS-37 Testing: Zep Multi-Clean Green had to pass performance tests (soil removal, etc.) equivalent to or better than a conventional cleaner to earn GS-37zep.comzep.com. So third-party labs validated its cleaning efficacy. – EPA Safer Choice Review: For certified Zep products, EPA vetted each ingredient's safety; also ensured product works in its category (through in-house or literature data). – ASTM D4488 (Greasy soil cleaning) and others: Zep likely tests their degreasers on standardized soils; results often show faster or more complete removal vs. competitors (internal data they share in B2B marketing). E.g., demonstration that Zep heavy-duty cleaner dissolves grease X% more in Y time than another product – often tested by application labs. – OSHA & DOT compliance tests: e.g., flash point tests for flammability (many Zep solvent cleaners have been tested to determine if they're flammable or combustible class – ensuring safe transport classification). – Customer field trials: Many large clients (city fleets, manufacturing plants) test multiple products and document results. Zep often publishes case studies (like a transit authority reduced cleaning time by 30% using Zep XYZ – implying a validation trial). – NTPEP: No specific mention, but Zep's asphalt release agents might be in NTPEP's test program (they test effectiveness and environmental compliance for such products). If so, being approved by NTPEP for DOT use is a robust validation. – EPA Registration tests: For Zep disinfectant cleaners (not the plain ones), AOAC germicidal tests by certified labs proved efficacy (some Zep products are hospital-grade disinfectants, requiring >6 log kill on pathogens). This showcases Zep's ability to have products rigorously tested, though it may not apply to the surfactant-only cleaners directly.	– Internal labs: Ecolab has a strong R&D – they test each formula for effectiveness (e.g., swabbing surfaces before/after cleaning to measure soil removal, shine, etc.). They often calibrate formulas to outperform competitors slightly. Many tests are confidential, but the results manifest in customer retention. – Third-party audits: Food and health regulators audit facilities using Ecolab products – indirectly validating that Ecolab's hygiene programs achieve required cleanliness standards (or the facility would fail inspection). – EPA registration data: Ecolab's sanitizers/disinfectants have large sets of third-party lab reports (AOAC tests for Salmonella, Staph, etc.; EN standards for Europe). For example, their Peroxide Multi-Surface Cleaner is EPA-registered to kill Norovirus in 45 seconds – backed by lab tests. This product also cleans – so it had to pass both cleaning efficiency and micro efficacy in third-party labs. – Sustainability metrics: Ecolab and an NGO (Trucost) developed a Water Risk Monetizerinvestor.ecolab.com – not product test, but shows their thought leadership. They also publish that using X product saved Y gallons of water or energy for a client (these savings are usually verified in pilot studies at client sites). – Comparative trials: When Ecolab introduces a new cleaner to a hotel chain, they often do a side-by-side trial vs. the previous product to ensure equal or better performance with less environmental impact. Those trial reports (though internal) are a form of validation Ecolab must provide to win contracts. – Certifications: Achieving Green Seal or Safer Choice on specific products means a third party verified both formula and performance (Green Seal includes performance tests supervised by their labs). Ecolab has done this where applicable. (NTPEP not relevant, but they do engage in industry standard tests for specific sectors, like ASTM sanitation standards in brewing, etc.)	– Green Seal GS-37 standardhillnmark – Safer Choice: EPA intended. – Dermatologist Te volunteers confirm populations). – Allergy Standards certification. The A (though not officia – Consumer Testin expectations (they leading competito – LCAs: They have c environmental foo toxic impact). This – Awards: Seventh product innovatio environmental clai – In use, Seventh G programs – those i trials or relying on needed validation